QUALITY ASSURANCE PROJECT PLAN
Peninsula Boulevard Site
Hewlett, New York

Revision 7

Prepared for:
United States Environmental Protection Agency/Environmental Response Team
Edison, New Jersey

By:
Lockheed Martin/Scientific, Engineering, Response and Analytical Services
Work Assignment Number: SERAS-149

Based on the Intergovernmental Data Quality Task Force Uniform
Federal Policy for Quality Assurance Project Plans
(Final Version 1.1, June 2006)

May 26, 2016

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QAPP Worksheet #1
Title and Approval Page

Site Name/Project Name: Peninsula Boulevard Site
Site Location: Hewlett, New York (NY)

Document Title: Quality Assurance Project Plan (QAPP) for Peninsula Boulevard Site – 2016 Groundwater Sampling and Water Level Monitoring Mobilization

Lead Organization: Environmental Protection Agency/Environmental Response Team (EPA/ERT)

Preparer's Name and Organizational Affiliation: Jean Bolduc, Lockheed Martin / Scientific, Engineering, Response and Analytical Services (SERAS)

Preparer's Address, Telephone Number, and E-mail Address: 2890 Woodbridge Avenue, Edison, New Jersey 08837, (732) 321-4280, jean.m.bolduc@lmco.com

Preparation Date (Month/Day/Year): May 26, 2016

Investigative Organization's Project Manager/ Date: _____ 5/31/16
Signature

Printed Name/Organization: Jeff Catanzarita/ERT Work Assignment Manager

Investigative Organization's Project QA Officer/Date: _____ 5/26/16
Signature

Printed Name/Organization: Stephen Blaze, ERT Quality Coordinator

Lead Organization's Project Manager/Date: Jean Bolduc 5/31/16
Signature

Printed Name/Organization: Jean Bolduc/SERAS Task Leader

Approval Signatures/Date: _____ 5/26/16
Signature

Printed Name/Title: Deborah Killeen/SERAS QA/QC Officer

Approval Authority: SERAS

Other Approval Signatures/Date: _____ 5/26/16
Signature

Printed Name/Title: Kevin Taylor/SERAS Program Manager

Document Numbering System: SERAS-149-DQAPPR7-052616

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Peninsula Boulevard Site
Site Location: Hewlett, NY
Site Number/Code: 02TV
Operable Unit: OU-2
Contractor Name: Lockheed Martin
Contractor Number: EP-W-09-031
Contract Title: SERAS
Work Assignment Number: SERAS-149

1. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

2. Identify approval entity: US EPA/ERT

3. The QAPP is (select one): ☐ Generic ☒ Project Specific

4. List dates of scoping sessions that were held: 05/16/16

5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
QAPP for Peninsula Boulevard Groundwater Plume Site, Response Engineering and Analytical Contract (REAC) document #0309-DQAPP-051308	5/13/08
QAPP for Peninsula Boulevard, Hewlett, New York, SERAS document SERAS-149-DQAPP-120511	12/06/11
QAPP for Peninsula Boulevard, Hewlett, New York, SERAS document SERAS-149-DQAPPA1-060713	06/07/13
QAPP for Peninsula Boulevard, Hewlett, New York, SERAS document SERAS-149-DQAPPA2-031714	03/24/14
QAPP for Peninsula Boulevard, Hewlett, New York, SERAS document SERAS-149-DQAPPA3-092314	09/24/14
Revised QAPP for Peninsula Boulevard – January 2015 Mobilization, Hewlett, New York, SERAS document SERAS-149-DQAPPR4-012115	01/23/15
Revised QAPP for Peninsula Boulevard – April 2015 Mobilization, Hewlett, New York, SERAS document SERAS-149-DQAPPR5-042315	04/23/15
Revised QAPP for Peninsula Boulevard – November 2015 Through January 2016 Mobilization, Hewlett, New York, SERAS document SERAS-149-DQAPPR6-111015	11/13/15

6. List organizational partners (stakeholders) and connection with lead organization: EPA Region 2

7. List data users: EPA Region 2

8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below:
Worksheet #37 – EPA Region 2 is responsible for the usability of the data

QAPP Worksheet #2
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QAPP Worksheet #3
Distribution List

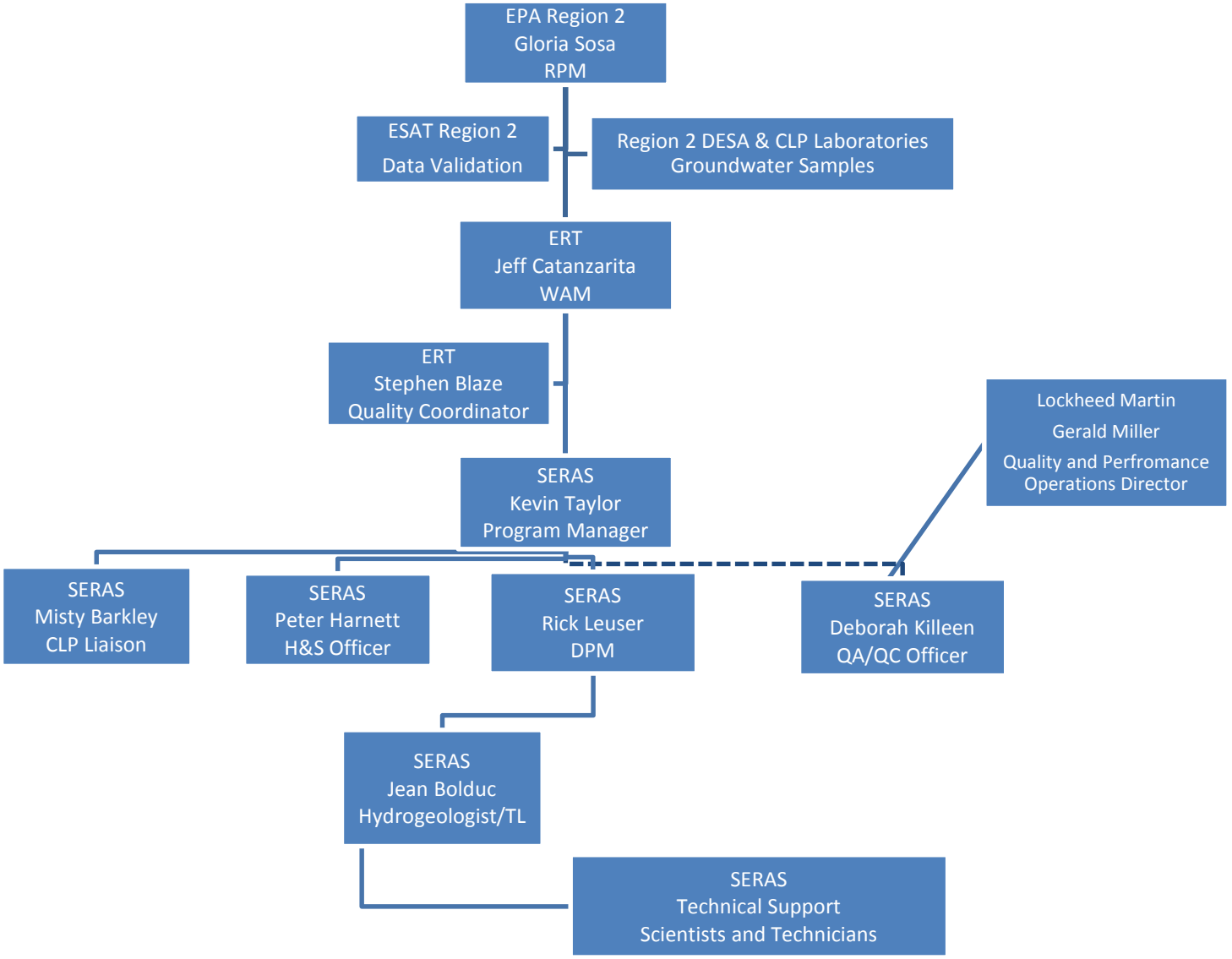
QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Jeff Catanzarita	Work Assignment Manager (WAM)	ERT	(732) 906-6929	(732) 321-6724	catanzarita.jeff@epamail.epa.gov	SERAS-149-DQAPPR7-052616
Stephen Blaze	Quality Coordinator	ERT	(732) 906-6921	(732) 321-6724	blaze.stephen@epamail.epa.gov	SERAS-149-DQAPPR7-052616
Gloria Sosa	Remedial Project Manager (RPM)	EPA Region 2	(212) 637-4283	(212) 637-3966	sosa.gloria@epamail.epa.gov	SERAS-149-DQAPPR7-052616
Jean Bolduc	Hydrogeologist/Task Leader (TL)	SERAS	(732) 321-4280	(732) 494-4021	jean.m.bolduc@lmco.com	SERAS-149-DQAPPR7-052616
Deborah Killeen	Quality Assurance/ Quality Control (QA/QC) Officer	SERAS	(732) 321-4245	(732) 494-4021	deborah.a.killeen@lmco.com	SERAS-149-DQAPPR7-052616
Richard Leuser	Deputy Program Manager (DPM)	SERAS	(732) 494-4060	(732) 494-4021	richard.m.leuser@lmco.com	SERAS-149-DQAPPR7-052616
Kevin Taylor	Program Manager	SERAS	(732) 321-4202	(732) 494-4021	kevin.c.taylor@lmco.com	SERAS-149-DQAPPR7-052616

QAPP Worksheet #4
Project Personnel Sign-Off Sheet

Organization: SERAS/EPA/ERT

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Jean Bolduc	SERAS Hydrogeologist/TL	(732) 321-4280		5/31/16
Jeff Catanzarita	ERT WAM	(732) 906-6929		5/31/16
Gloria Sosa	EPA RPM	(212) 637-4283		
Joe Policastri	SERAS Environmental Technician	(732) 321-4265		5-31-16
Christopher French	SERAS Environmental Technician	(732) 494-4040		5/31/16
Scott Grossman	SERAS Environmental Scientist	(732) 321-4237		

QAPP Worksheet #5
Project Organizational Chart



QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Approval of initial QAPP and any amendments	ERT WAM ERT Quality Manager SERAS Program Manager SERAS QA/QC Officer SERAS TL	Jeff Catanzarita Stephen Blaze Kevin Taylor Deborah Killeen Jean Bolduc	(732) 906-6929 (732) 906-6921 (732) 321-4202 (732) 321-4245 (732) 321-4280	SERAS internal peer review, followed by ERT approval, implementation of changes effective only with approved QAPP or QAPP Change Form.
Nonconformance and Corrective Action	SERAS TL ERT WAM SERAS QA/QC Officer	Jean Bolduc Jeff Catanzarita Deborah Killeen	(732) 321-4280 (732) 906-6929 (732) 321-4245	Use of the Work Assignment Field Change Form for field issues.
Posting of Deliverables to the ERT Information Management System (IMS) website	SERAS TL SERAS QA/QC Officer SERAS Administrative Support SERAS Deputy Program Manager	Jean Bolduc Deborah Killeen Eileen Ciambotti Rick Leuser	(732) 321-4280 (732) 321-4245 (732) 321-4255 (732) 494-4060	As per work assignment, posting of deliverables to ERT-IMS website constitutes delivery to the WAM.
Work Assignment (WA)	SERAS Program Manager	Kevin Taylor	(732) 321-4202	Describes scope of work to SERAS personnel from the ERT WAM.
Health and Safety On-Site Meeting	SERAS TL and/or Site Health and Safety Officer	Jean Bolduc	(732) 321-4280	Describe potential site hazards, required personal protective equipment, and access to local emergency services.

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Jean Bolduc	Hydrogeologist/TL	SERAS	Project Supervision/Subcontractor Oversight/Site Health and Safety Officer	Minimum BS degree plus 8 years related experience/LM Employee Files
Christopher French	Environmental Technician	SERAS	Field Activities/Sampling/Scribe	Environmental sampling experience/LM Employee Files
Joe Policastri	Environmental Technician	SERAS	Field Activities/Sampling	Environmental sampling experience/LM Employee Files
Scott Grossman	Environmental Scientist	SERAS	Field Activities/Sampling/Scribe	B.S. Biology, M.S. and 8 years plus of environmental experience/Lockheed Martin Employee Files
Mingling Li	Geographic Information System (GIS) Specialist	SERAS	GIS/Map Making	Minimum B.S. degree plus 3 years of related experience/Lockheed Martin Employee Files
Deborah Killeen	QA/QC Officer	SERAS	QA/Deliverable Review	Minimum BS degree plus 14 years related experience/ LM Employee Files
Kevin Taylor	Program Manager	SERAS	Program Oversight	Minimum B.S. degree plus 14 years of related experience/LM Employee Files
Peter Harnett	Health and Safety Officer	SERAS	HASP Review, PPE Selection, H&S Oversight	Minimum B.S. degree plus 14 years of related experience/LM Employee Files
Jeff Catanzarita	WAM	EPA/ERT	Technical Direction; Contract Laboratory Program (CLP) Coordination	EPA job-specific qualifications/In EPA files
Gloria Sosa	RPM	EPA Region 2	Technical Oversight	EPA job-specific qualifications/In EPA files
Stephen Blaze	Quality Coordinator	EPA/ERT	QA Oversight	EPA job-specific qualifications/In EPA files

HASP = health and safety plan
PPE = personal protective equipment
H&S = health and safety

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Project/Subcontractor Oversight	40 Hours + 8 Hr Annual Refresher Health & Safety Training	SERAS	Sept 2016*	Jean Bolduc	TL/ Hydrogeologist/ SERAS	SERAS H&S Files
Field Activities	40 Hours + 8 Hr Annual Refresher Health & Safety Training	SERAS	Nov 2016*	Scott Grossman	Environmental Scientist/SERAS	SERAS H&S Files
Field Activities	40 Hours + 8 Hr Annual Refresher Health & Safety Training	SERAS	Jun 2016*	Joe Policastri	Environmental Technician/ SERAS	SERAS H&S Files
Field Activities	40 Hours + 8 Hr Annual Refresher Health & Safety Training	SERAS	Nov 2016*	Christopher French	Environmental Technician/ SERAS	SERAS H&S Files
QA Oversight	Uniform Federal Policy for Quality Assurance Project Plans	Advanced Systems	Jan 2006	Deborah Killeen	QA/QC Officer/SERAS	Quality Files

* Date training expires.

QAPP Worksheet #9
Project Scoping Session Participants Sheet

Project Name: Peninsula Boulevard Site (WA# SERAS-149.4) **Projected Date(s) of Sampling:** Beginning 11/16/15 **Project Manager:** Jean Bolduc	**Site Name:** Peninsula Boulevard Site **Site Location:** Hewlett, NY

Date of Session: 05/16/16
Scoping Session Purpose: Discuss logistics and field/laboratory activities for the work assignment (continuation of the remedial investigation for OU-2).

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Jean Bolduc	TL/Hydrogeologist	SERAS	732-321-4280	jean.m.bolduc@lmco.com	Task Leader
Jeff Catanzarita	ERT WAM	EPA/ERT	732-906-6929	catanzarita.jeff@epa.gov	Technical Direction

Comments/Decisions:

Field activities will include:

- Up to four days of groundwater sampling during which pressure transducers with onboard dataloggers will be deployed in a subset of the site-related monitoring wells for a water level study involving the shallow and deep Upper Glacial Aquifer. Note: multiple groundwater sampling and/or water level monitoring events may be conducted under this QAPP until the end of the SERAS contract.
- One month of automated water level monitoring by the transducers.
- One day of transducer removal at the end of the water level monitoring event.

Laboratory and data validation activities will include:

- Groundwater sample analysis for low concentrations of VOCs by the EPA Region 2 Division of Environmental Science and Assessment (DESA) Laboratory. If required, backup analysis for VOCs will be performed by a laboratory in the Contract Laboratory Program (CLP) with associated data validation conducted by the Environmental Services Assistance Team (ESAT). Benchmarks for the groundwater analytical results are the New York State Department of Environmental Conservation Class GA Groundwater Standards.

Reporting activities will include:

- Trip Report documenting the materials, methods, and findings of the groundwater monitoring.
- Trip Report documenting the materials, methods, and findings of the water level study.

Action Items: It is anticipated that the rental company supplying the pressure transducers for the water level study will require at least one-week notification prior to the mobilization. An EPA Region 2 Analytical Services Request Form has been submitted to schedule the groundwater sample analysis at the DESA Laboratory.

Consensus Decisions: Performance evaluation samples will be required if the groundwater samples are sent for VOC analysis to a CLP laboratory. The purpose of this mobilization is to further characterize potential sources for the VOCs detected in groundwater beneath the area and to identify if fluctuating water levels are causing the groundwater flow dynamics observed for the shallow Upper Glacial Aquifer to differ from those observed for the deep Upper Glacial Aquifer beneath the area. The data will be used for the engineering design of an applicable source remedy.

QAPP Worksheet #10
Problem Definition

The problem to be addressed by the project:
ERT in conjunction with US EPA Region 2 will be conducting groundwater sampling for VOC contamination source characterization and water level monitoring for groundwater flow characterization at the Peninsula Boulevard Site in Hewlett, NY. SERAS personnel will collect the groundwater samples from passive diffusion bags previously installed in the monitor wells listed in Worksheet #17. SERAS personnel will also deploy pressure transducers to collect water level data for one month in monitor wells ERT-MW-3S/D, ERT-MW-7S/D, ERT-MW-12S/D, and MW-15S/D. The field activities will begin during the last week of May 2016. Multiple mobilizations for additional groundwater sampling and water level monitoring may be conducted under this QAPP.

The environmental questions being asked:
What is the nature and extent of the VOCs detected in the groundwater at suspected source properties on the Peninsula Boulevard site?
What are the temporal variations in groundwater flow dynamics (directions, gradients, and groundwater divides) within the shallow and deep Upper Glacial Aquifer in the southern portion of the Peninsula Boulevard site?

Observations from any site reconnaissance reports:
The Peninsula Boulevard Groundwater Plume Superfund Site (Site) consists of the area within and around a groundwater plume located in the Village of Hewlett, Town of Hempstead, Nassau County, NY. The area consists of a mix of commercial and residential properties, with the majority of the commercial properties being located along Mill Road, Peninsula Boulevard, Broadway, and West Broadway.

A series of investigations and removal actions performed by the New York State Department of Environmental Conservation (NYSDEC) from 1991 to 1999 at the former Grove Cleaners site revealed an extensive groundwater contaminant plume extending both to the north and south of Peninsula Boulevard, primarily consisting of the chlorinated volatile organic compound PCE. The results of these investigations determined that operations at the former Grove Cleaners, located at 1274 Peninsula Boulevard from 1987 to 1992, resulted in the disposal of hazardous substances, including the VOCs PCE and TCE to the environment. In March 1991, the Nassau County Department of Health (NCDH) cited Grove Cleaners for discharging hazardous waste into on-site dry wells. PCE was detected in soil and sludge samples collected at the Grove Cleaners site and in other media at and near the property. The results of the investigation suggested the potential for additional source areas other than the former Grove Cleaners site. Following the implementation of interim remedial measures, which consisted of the removal of impacted soil related to solvent discharge to a dry well, a No Further Action remedy was selected by NYSDEC in March 2003 for the former Grove Cleaners site. On March 7, 2004, the EPA proposed inclusion of the site on the National Priorities List (NPL); on July 22, 2004, EPA placed the site on the NPL.

EPA conducted a Remedial Investigation (RI) at the Site from 2005 through 2010. Environmental sampling of groundwater, surface water, soil and sediment was performed and a Data Evaluation Report (DER) presenting the results of the environmental sampling was prepared in October 2008. Supplemental RI work was conducted in 2010 to address data gaps, including hydrogeological sampling and analyses, and to develop a baseline human health risk assessment (HHRA) and screening-level ecological risk assessment (SLERA). A DER Addendum was issued in December 2010 presenting the results of this sampling. An RI Report was released in June 2011. The RI identified groundwater contaminated with PCE, PCE-breakdown products, and low levels of other VOCs.

The source of the PCE groundwater contamination is suspected to be upgradient of the dry cleaning properties. Previous environmental investigations conducted by SERAS during 2012 to 2016 at two upgradient dry cleaning properties and a vacant property detected soil and groundwater contamination. Groundwater samples collected in February 2016 by SERAS from monitor wells on Cedarwood Cleaners and the vacant lot contained high concentrations of VOCs. Groundwater level data collected by SERAS in February and April 2016 indicated a previously unknown groundwater divide may be present in the deep Upper Glacial Aquifer beneath the Peninsula Boulevard site.

A synopsis of existing data or information from site reports:
Analytical results from soil vapor sampling conducted by SERAS in 2012 indicate that potential VOC contamination sources exist at three dry cleaners: Cedarwood Cleaners, Piermont Cleaners, and Former Vogue French Cleaners/Liberty Travel. A membrane interface probe hydraulic profiling tool (MiPHT) survey conducted by SERAS in 2013 indicated that Cedarwood Cleaners may be a primary source and Piermont Cleaners may be a secondary source of VOC contamination. Soil and groundwater samples collected in 2015/2016 at a vacant property across West Broadway from Cedarwood Cleaners also contained high concentrations of VOCs. Groundwater level data collected by SERAS from newly installed monitor wells in early 2016 indicated a groundwater divide may be present in the deep Upper Glacial Aquifer beneath the southern portion of the Peninsula Boulevard site.

The possible classes of contaminants and the affected matrices:
VOC contamination of groundwater. The target compounds of interest are primarily PCE and TCE.

The rationale for inclusion of chemical and nonchemical analyses:
Previous environmental investigations conducted by SERAS detected VOC contamination of groundwater at suspected source locations and potentially anomalous groundwater flow conditions at the Peninsula Boulevard site.

Information concerning various environmental indicators:
VOCs were recently detected at high concentrations exceeding regulatory standards in newly installed (2015/2016) wells at the suspected source properties. The current concentrations of VOCs are unknown in previously installed (2007/2010) shallow and deep monitor wells located in the surrounding neighborhood. A divide in the deep Upper Glacial Aquifer may be directing the migration of VOC contamination in groundwater from Cedarwood Cleaners toward Piermont Cleaners at the Peninsula Boulevard site. It is unknown if that groundwater divide is a permanent or transient feature of the local flow system in the deep Upper Glacial Aquifer.

Project decision conditions ("If..., then..." statements):
If VOC contamination is detected in the groundwater samples from newly and previously installed monitor wells, then the data will be evaluated to further delineate the extent of that contamination. This mobilization is to further characterize the potential sources and their boundaries; therefore, the existing project action limits will be used to guide these activities.
If the concentrations of VOCs detected in groundwater samples from this mobilization are found to be higher than those previously reported in the samples from February 2016, then additional modeling of the groundwater contamination will be performed. Three-dimensional modeling of site-related data is covered in Revision 6 of this QAPP.
If water levels are observed to be fluctuating in the shallow and deep Upper Glacial Aquifer, then the data will be evaluated to identify the effects of those fluctuations on the local groundwater flow regime.

QAPP Worksheet #11
Project Quality Objectives /Systematic Planning Process Statements

Who will use the data? EPA Region 2

What will the data be used for?
The data will be used by EPA Region 2 to: 1) verify and further delineate previous findings of VOC contamination in groundwater at Cedarwood Cleaners, Piermont Cleaners and a vacant lot and 2) verify and further investigate previous findings of a groundwater divide in the deep Upper Glacial Aquifer near Cedarwood and Piermont Cleaners.

What type of data is needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)
DESA or CLP laboratory analytical results for VOCs (PCE and TCE are the drivers) in groundwater samples. Water level data from pressure transducers installed in monitor wells screening the shallow and deep Upper Glacial Aquifer.

How "good" do the data need to be in order to support the environmental decision?
VOC analytical results for groundwater are definitive laboratory data. Water levels measured by the pressure transducers are screening data. Worksheets #12 and #28 show the measurement performance criteria that are needed for the quality indicators. Worksheet #20 outlines the field quality control sample requirements.

How much data are needed? (number of samples for each analytical group, matrix, and concentration)
Thirty-four groundwater samples will be collected from monitor wells at Cedarwood Cleaners, Piermont Cleaners, a vacant lot across from Cedarwood Cleaners on West Broadway, and the neighborhood surrounding those locations. Those groundwater samples will be collected from monitor wells recently installed in 2015/2016 (at Piermont Cleaners, Cedarwood Cleaners, and the vacant lot) and from monitor wells previously installed in 2007 and 2010 (at locations in the surrounding neighborhood). All groundwater samples will be analyzed for VOCs.
Pressure transducers will be installed in eight monitor wells at the site and one stilling well along nearby Macy Channel to collect water level data for one month. The transducers will be preprogrammed to measure water levels every minute in the wells. Water level measured by the transducers will be the height of the water column above the transducer in the monitors and will be automatically corrected for barometric pressure. Data recorded by the transducers will be remotely transmitted on a cellular network and stored on a HydroVu Data website. The corrected heights exported from the website will be converted into groundwater level elevations by subtracting the depth to water (below top of casing) data (recorded when the transducers were deployed in the monitor wells) from the top of casing elevations for the monitor wells. Flow maps representing the shallow and deep Upper Glacial Aquifer will be constructed using the groundwater elevation data.

Where, when, and how should the data be collected/generated?
Groundwater samples will be collected from newly installed and previously installed monitor wells using passive diffusion bags. Water level data will be measured by pressure transducers in a subset of those monitor wells. The groundwater sampling and water level monitoring will begin during the last week of May 2016. Multiple mobilizations for groundwater sampling and water level monitoring may be conducted under this QAPP.

Who will collect and generate the data?
Groundwater samples will be collected by SERAS and relinquished to either the EPA Region 2 DESA or CLP laboratories for analysis. Data generated by DESA will be reviewed in-house prior to submittal to the WAM. Data generated by the CLP laboratory will be validated by ESAT prior to submittal to the WAM.
Water level data will be downloaded from the HydroVu Data website, processed by SERAS, and peer reviewed in-house before submittal to the WAM.

How will the data be reported?
Validated CLP and reviewed DESA data for groundwater samples will be reported directly to the WAM and forwarded on to the SERAS TL. A final Trip Report, containing the groundwater analytical and water level data, prepared in accordance with SERAS Standard Operating Procedure (SOP) #4017, *Preparation of Trip Reports*, will be the final deliverable to the EPA/ERT WAM. Data will be disseminated to EPA Region 2 by the ERT WAM.

How will the data be archived?
Hard copies of all deliverables will be stored in SERAS Central Files and e-copies will be stored on the SERAS local area network (LAN). Analytical results and GPS data will be imported into a Scribe database and posted to the ERT- IMS website. All deliverables will be archived by SERAS in accordance with Administrative Procedure (AP) #34, *Archiving Electronic Files*.

QAPP Worksheet 12-1
Measurement Performance Criteria Table

Matrix	Aqueous
Analytical Group[1]	VOC
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP*	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2007	SOP #C-89	Precision/ Accuracy	% RPD < 20 Average Recovery 70-130%	LCS Duplicate	A
		Accuracy	Factor of two(-50% to + 100%) from the initial/continuing calibration	Internal standards	A
		Accuracy	Compound Specific (full range: 17-259%)	Matrix spike	A
		Accuracy	Limits 70%-130%(Aqueous)	Surrogate Compounds	A
		Accuracy	< RL	Method Blank	A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23
*Reference USEPA Region 2 SOP No. C-89 Analysis of Volatile Organic Compounds in Aqueous and Waste Oil/Waste Organic Solvent Samples by Purge and Trap GC/MS
RPD = Relative Percent Difference
LCS = Laboratory Control Sample
RL = Reporting Limit

QAPP Worksheet 12-2
Measurement Performance Criteria Table

Matrix	Aqueous
Analytical Group	TCL voc
Concentration Level	Low/Medium (µg/L)

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2007	SOM02.2	Precision (field)	± 20% RPD	Field Duplicate	S & A
		Accuracy (field)	No analyte > CRQL*	Equipment (Field) Blank/Method Blank	S & A
		Precision (laboratory)	± 20% RPD; List compound specific RPD	Field Duplicate; MS/MSD**	S & A; A
		Accuracy (laboratory)	List compound specific %R	***DMCs; MS/MSD**	A
		Completeness	> 90% water sampling > 90% laboratory analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23
*Reference USEPA Region 2 SOP No. 24/Low/Medium – Blank Type Criteria Table
**Optional MS/MSD – Reference CLP SOM02.2 Exhibit D, Table 6 for Criteria
***Deuterated Monitoring Compounds (DMCs) – Reference CLP SOM02.2, Exhibit D, Table 5 for Criteria
RPD = Relative Percent Difference
CRQL = Contract Required Quantitation Limit
MS/MSD = Matrix Spike/Matrix Spike Duplicate
%R = Percent Recovery

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Soil Gas and Groundwater Sampling Data	SERAS, Peninsula Boulevard Site, Hewlett, New York, February 2012 Soil Gas and Ground Water Sampling Work Assignment #SER00149 – Trip Report	SERAS, Definitive Data, Soil Gas and Groundwater Sampling Data, Collected February 6 to 10, 2012	The soil gas and groundwater sampling data will be used to identify MiHPT sampling locations at each of the three dry cleaner sites involved in this investigation.	None
MiHPT Survey Data	S2C2, Subsurface Characterization Using Membrane Interface Probe (MIP) With Heated Trunkline, Town of Hewlett, New York, July 19, 2013	S2C2, Inc., Screening Data, MiHPT data collected June 17 through 27, 2013	The MiHPT data will be used to identify soil borehole and groundwater monitor well locations for sampling at each of the three dry cleaner sites involved in this assessment.	None
Soil and Groundwater Sampling Data	SERAS, Peninsula Boulevard Site, Hewlett, New York, Draft Technical Memorandum, SERAS-0149-DTM-051116	SERAS, Definitive Data, Soil Gas, MiHPT, Soil and Groundwater Sampling Data, Collected from January 2012 through February 2016	Data will be used to guide the continuation of the delineation effort in 2016.	None

QAPP Worksheet #14
Summary of Project Tasks

Sampling Tasks:
SERAS personnel will collect groundwater samples (number to be determined by the WAM) in accordance with SERAS SOP #2007, *Groundwater Well Sampling* and deploy the pressure transducers for water level monitoring in accordance with SERAS SOP #2017*, Submersible Pressure Transducers*.

Analysis Tasks:
Groundwater samples will be analyzed for low concentrations of VOCs by the DESA Laboratory. The target analyte list is summarized in Table 1 of SOP# C-89 (see Worksheet #15-1). If the groundwater samples are analyzed for VOCs by a backup CLP laboratory, then the standard CLP target analyte list will be used (see Worksheet #15-2).

Quality Control Tasks:
SERAS will collect QC samples for the groundwater sampling in accordance with EPA DESA/CLP guidelines or policies and SERAS SOP #2005, *Quality Assurance/Quality Control Samples.* Field QC samples are described on Worksheet #20 and analytical QC samples are listed on Worksheet #28.

Existing Data:
Refer to Worksheet #13.

Data Management Tasks:
All groundwater sample locations will be identified by a field assigned number. If a backup laboratory is necessary, all groundwater samples will be identified by a CLP assigned number. All deliverables will be generated in accordance to the appropriate SERAS SOP and posted to the ERT-IMS website upon completion. Posting to the ERT-IMS site will be considered as completion of the deliverable.
Water level data uploaded to the HydroVu Data website will be organized according to the well name/identification number.

Documentation and Records:
All documentation will be recorded in accordance with SERAS SOP #4001, *Logbook Documentation*. The Trip Report will provide a description of the project; field methodologies and results, and will be prepared in accordance with SERAS SOP #4017, *Preparation of Trip Report*. Documents and records that may be generated during this project include: amended Work Plan (WP), revised QAPP, modified HASP, Scribe database, and Trip Report.

Assessment/Audit Tasks:
No performance audit of field operations is anticipated for this project. The tasks associated with this revised QAPP are assessed using peer reviews and management system reviews. Peer review enables reporting errors to be corrected before reports are submitted. Management system reviews establish compliance with prevailing management structure, policies and procedures, and ensures that the required data are obtained.

Data Review Tasks:
All project deliverables will receive an internal peer review prior to release, per guidelines established in the SERAS AP #22, *Peer Review of SERAS Deliverables*.

Analytical data deliverables for CLP VOCs will be in accordance with the U.S. EPA CLP *Multi-Media Multi-Concentration Organic Analysis [SOM02.2]*. The organic data will be validated according to U.S. EPA/DESA/HWSS SOP Number HW-33/ *Low/Medium Volatile Data Validation,* Revision 3 and SOP Number HW-34, *Trace Volatile Data Validation*.

QAPP Worksheet 15-1
Reference Limits and Evaluation Table

Matrix: Aqueous

Analytical Group: VOC (DESA)

Concentration Level: Trace and Low

Analyte	CAS Number	Project Action Limits NYSDEC 6NYCRR Part 703 (µg/L)**	Project Quantitation Limit (µg/L)	Analytical Method – SOP #C-89 (Low) Quantitation Limits (µg/L)	Achievable Laboratory (DESA) Limits (µg/L)
Dichlorodifluoromethane	75-71-8	5	0.5	5	0.153
Chloromethane	74-87-3	NS	0.5	5	0.301
Vinyl Chloride	75-01-4	2	0.5	5	0.340
Bromomethane	74-83-9	5	0.5	5	0.810
Chloroethane	75-00-3	5	0.5	5	0.228
Trichlorofluoromethane	75-69-4	5	0.5	5	0.109
1,1-Dichloroethene	75-35-4	5	0.5	5	0.252
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5	0.5	5	0.129
Acetone	67-64-1	NS	5	10	0.533
Carbon Disulfide	75-15-0	60	0.5	5	0.303
Methyl Acetate	79-20-9	NS	0.5	5	0.235
Methylene Chloride	75-09-2	5	0.5	5	0.176
trans-1,2-Dichloroethene	156-60-5	5	0.5	5	0.179
Methyl tert-Butyl Ether	1634-04-4	10	0.5	5	0.059
1,1-Dichloroethane	75-34-3	5	0.5	5	0.098
cis-1,2-Dichloroethene	156-59-2	5	0.5	5	0.069
2-Butanone (MEK)	78-93-3	NS	5	10	0.212
Bromochloromethane	74-87-5	NS	0.5	5	0.114
Chloroform	67-66-3	7	0.5	5	0.100
1,1,1-Trichloroethane	71-55-6	5	0.5	5	0.118
Cyclohexane	110-82-7	NS	0.5	5	0.114
Carbon Tetrachloride	56-23-5	5	0.5	5	0.120
Benzene	71-43-2	1	0.5	5	0.114
1,2-Dichloroethane	107-06-2	0.6	0.5	5	0.118
Trichloroethene	79-01-6	5	0.5	5	0.191
Methylcyclohexane	108-87-2	NS	0.5	5	0.122
Bromodichloromethane	75-27-4	5	0.5	5	0.114

Reference Limits and Evaluation Table

Matrix: Aqueous

Analytical Group: VOC (DESA) - Continued

Concentration Level: Trace and Low

Analyte	CAS Number	Project Action Limits NYSDEC 6NYCRR Part 703 (µg/L)**	Project Quantitation Limit (µg/L)	Analytical Method – SOP #C-89 (Low) Quantitation Limits (µg/L)	Achievable Laboratory (DESA) Limits (µg/L)
1,2-Dichloropropane	78-87-5	1	0.5	0.5	0.128
Toluene	108-88-3	5	0.5	0.5	0.090
trans-1,3-Dichloropropene	10061-02-6	0.4	0.5	0.5	0.224
cis-1,3-Dichloropropene	10061-01-5	NS	0.5	0.5	0.120
4-Methyl-2-Pentanone	108-10-1	NS	5	5	0.076
1,1,2-Trichloroethane	79-00-5	1	0.5	0.5	0.158
Tetrachloroethene	127-18-4	5	0.5	0.5	0.172
2-Hexanone	591-78-6	NS	5	5	0.182
Dibromochloromethane	124-48-1	NS	0.5	0.5	0.114
1,2-Dibromoethane	106-93-4	NS	0.5	0.5	0.191
Chlorobenzene	108-90-7	5	0.5	0.5	0.138
Ethylbenzene	100-41-4	5	0.5	0.5	0.160
o-Xylene	95-47-6	5	0.5	0.5	0.079
m/p-Xylene	108-38-3/ 106-42-3	5	0.5	0.5	0.233
Styrene	100-42-5	5	0.5	0.5	0.102
Bromoform	75-25-2	NS	0.5	0.5	0.095
Isopropylbenzene	98-82-8	5	0.5	0.5	0.107
1,1,2,2-Tetrachloroethane	79-34-5	5	0.5	0.5	0.159
1,3-Dichlorobenzene	541-73-1	5	0.5	0.5	0.122
1,4-Dichlorobenzene	106-46-7	5	0.5	0.5	0.160
1,2-Dichlorobenzene	95-50-1	5	0.5	0.5	0.200
1,2-Dibromo-3-chloropropane	96-12-8	0.04	0.5	0.5	0.273
1,2,4-Trichlorobenzene	120-82-1	5	0.5	0.5	0.237
1,2,3-Trichlorobenzene	87-61-6	NS	0.5	0.5	0.264

**New York State Department of Environmental Conservation (NYSDEC), August 1999, 6 NYCRR Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations. Value listed from Table 1 of Section 703.5 for Class GA waters and Health Water Source standards.
NS = not specified in **
µg/L = micrograms per liter.

QAPP Worksheet 15-2
Reference Limits and Evaluation Table

Matrix: Aqueous

Analytical Group: TCL VOC (CLP)

Concentration Level: Trace and Low

Analyte	CAS Number	Project Action Limits NYSDEC 6NYCRR Part 703 (µg/L)**	Project Quantitation Limit (µg/L)	Analytical Method – SOM01.2 (Trace) Quantitation Limits (µg/L)	Analytical Method – SOM01.2 (Low) Quantitation Limits (µg/L)
Dichlorodifluoromethane	75-71-8	5	0.5	0.5	5
Chloromethane	74-87-3	NS	0.5	0.5	5
Vinyl Chloride	75-01-4	2	0.5	0.5	5
Bromomethane	74-83-9	5	0.5	0.5	5
Chloroethane	75-00-3	5	0.5	0.5	5
Trichlorofluoromethane	75-69-4	5	0.5	0.5	5
1,1-Dichloroethene	75-35-4	5	0.5	0.5	5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5	0.5	0.5	5
Acetone	67-64-1	NS	5	5	10
Carbon Disulfide	75-15-0	60	0.5	0.5	5
Methyl Acetate	79-20-9	NS	0.5	0.5	5
Methylene Chloride	75-09-2	5	0.5	0.5	5
trans-1,2-Dichloroethene	156-60-5	5	0.5	0.5	5
Methyl tert-Butyl Ether	1634-04-4	10	0.5	0.5	5
1,1-Dichloroethane	75-34-3	5	0.5	0.5	5
cis-1,2-Dichloroethene	156-59-2	5	0.5	0.5	5
2-Butanone (MEK)	78-93-3	NS	5	5	10
Bromochloromethane	74-87-5	NS	0.5	0.5	5
Chloroform	67-66-3	7	0.5	0.5	5
1,1,1-Trichloroethane	71-55-6	5	0.5	0.5	5
Cyclohexane	110-82-7	NS	0.5	0.5	5
Carbon Tetrachloride	56-23-5	5	0.5	0.5	5
Benzene	71-43-2	1	0.5	0.5	5
1,2-Dichloroethane	107-06-2	0.6	0.5	0.5	5
1,4-Dioxane	123-91-1	NS	100	-	100
Trichloroethene	79-01-6	5	0.5	0.5	5
Methylcyclohexane	108-87-2	NS	0.5	0.5	5
Bromodichloromethane	75-27-4	5	0.5	0.5	5

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Aqueous

Analytical Group: TCL Volatiles (CLP) - Continued

Concentration Level: Trace and Low

Analyte	CAS Number	Project Action Limits NYSDEC 6NYCRR Part 703 (µg/L)**	Project Quantitation Limit (µg/L)	Analytical Method – SOM01.2 (Trace) Quantitation Limits (µg/L)	Analytical Method – SOM01.2 (Low) Quantitation Limits (µg/L)
1,2-Dichloropropane	78-87-5	1	0.5	0.5	5
Toluene	108-88-3	5	0.5	0.5	5
trans-1,3-Dichloropropene	10061-02-6	0.4	0.5	0.5	5
cis-1,3-Dichloropropene	10061-01-5	NS	0.5	0.5	5
4-Methyl-2-Pentanone	108-10-1	NS	5	5	10
1,1,2-Trichloroethane	79-00-5	1	0.5	0.5	5
Tetrachloroethene	127-18-4	5	0.5	0.5	5
2-Hexanone	591-78-6	NS	5	5	10
Dibromochloromethane	124-48-1	NS	0.5	0.5	5
1,2-Dibromoethane	106-93-4	NS	0.5	0.5	5
Chlorobenzene	108-90-7	5	0.5	0.5	5
Ethylbenzene	100-41-4	5	0.5	0.5	5
o-Xylene	95-47-6	5	0.5	0.5	5
m/p-Xylene	108-38-3/ 106-42-3	5	0.5	0.5	5
Xylenes (total)	1330-20-7	5	0.5	0.5	5
Styrene	100-42-5	5	0.5	0.5	5
Bromoform	75-25-2	NS	0.5	0.5	5
Isopropylbenzene	98-82-8	5	0.5	0.5	5
1,1,2,2-Tetrachloroethane	79-34-5	5	0.5	0.5	5
1,3-Dichlorobenzene	541-73-1	5	0.5	0.5	5
1,4-Dichlorobenzene	106-46-7	5	0.5	0.5	5
1,2-Dichlorobenzene	95-50-1	5	0.5	0.5	5
1,2-Dibromo-3-chloropropane	96-12-8	0.04	0.5	0.5	5
1,2,4-Trichlorobenzene	120-82-1	5	0.5	0.5	5
1,2,3-Trichlorobenzene	87-61-6	NS	0.5	0.5	5

**New York State Department of Environmental Conservation (NYSDEC), August 1999, 6 NYCRR Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations. Value listed from Table 1 of Section 703.5 for Class GA waters and Health Water Source standards.
NS = not specified in **
µg/L = micrograms per liter.

QAPP Worksheet #16
Project Schedule Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Quality Assurance Project Plan	SERAS	05/11/16	05/26/16	Revised QAPP	05/31/16
Field Work	SERAS	05/31/16	06/03/16	NA	NA
Groundwater Sample Analysis	EPA Region 2 DESA Laboratory	06/01/16	TBD	Data Package	28 days after completion of analysis
Draft Trip Report	SERAS	Upon receipt of final data package	Prior to July 11, 2016	Draft Trip Report	July 11, 2016
Final Trip Report	SERAS	TBD	TBD	Final Trip Report	5 business days after receipt of WAMs comments on draft

TBD – To Be Determined

QAPP Worksheet #17
Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):
EPA Region 2 and ERT personnel will determine sampling locations at the properties during this mobilization and any subsequent mobilizations. All sampling will be judgmental and the sampling locations will be selected based on the presence of VOC concentrations detected in groundwater and the water levels measured in monitor wells during previous environmental investigations at the site.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations)
Thirty-four groundwater samples will be collected and analyzed for low concentrations of VOCs. The monitor wells to be sampled include:

- Wells recently installed during 2015/2016 at Cedarwood Cleaners, Piermont Cleaners, and the vacant lot at 1255 West Broadway (MW-ERT-1 through MW-ERT-12); and
- Wells previously installed during 2007 and 2010 in the surrounding neighborhood (PZ-8, PZ-10, MW-15, MW-17, MW-18S/D, MW-19, MW-21, MW-22, MW-23, and MW-14).

Groundwater sampling will begin during the last week of May 2016. Pressure transducers will be installed (in wells ERT-MW-3S/D, ERT-MW-7S/D, ERT-MW-12S/D, and MW-15S/D) immediately after the wells have returned to static conditions during the May sampling event. A pressure transducer will also be installed in a stilling well (2-inch PVC casing attached to dock pier) in Macy Channel near the site. The transducers will monitor water levels at one-minute intervals in the wells for one month. Multiple mobilizations for groundwater sampling and water level monitoring may be conducted under this QAPP.

QAPP Worksheet #18
Survey Locations and Methods/SOP Requirements Table

Sampling Location/ID Number[1]	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples[4] (identify field duplicates)	Sampling SOP Reference[2]	Rationale for Sampling Location[3]
MW-ERT-1/S through MW-ERT-12S/D, PZ-8, PZ-10, MW-17, MW-18S/D, MW-19, MW-21, MW-22, MW-23 and MW-24 (Contamination Delineation)	Aqueous	Top, bottom, or middle of screened interval in monitor well	VOC	Low	34 (field duplicates 1:20)	2007	Judgmental

[1]Samples will be collected from several monitor wells containing more than one passive diffusion bag.
[2]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #21)
[3]Refer to Worksheet #17
[4]Many of the wells contain more than one PDB within the screened interval.

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference [1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Aqueous	VOC [DESA]	Low	SOP #C-89	120 mL	(3) 40 mL vials	Cool to ≤6°C °C pH <2 with 1:1 HCl	14 days
	TCL VOC [CLP]	Trace/Low	SOM02.2	120 mL	(3) 40 mL vials	Cool to ≤6°C °C pH <2 with 1:1 HCl	14 days

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).
MS/MSD samples will be collected at a rate of 1:20 and will consist of six 40-ml vials preserved as required above.

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	Inorganic No. of MS	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Aqueous (DESA Laboratory)	VOC	Low	C-89	34	5%	5%	TBD	0	0	TBD
Aqueous (Backup CLP Laboratory)	VOC	Trace/Low	CLP SOM02.2	TBD	5%	NA	TBD	0	TBD	TBD

TBD - To Be Determined

QAPP Worksheet #21
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
2001	General Field Sampling Guidelines, Rev. 1.0, 06/07/13	SERAS	General Sampling		
2002	Sample Documentation, Rev. 1.0, 01/04/16	SERAS	General Sampling		
2003	Sample Storage, Preservation and Handling, Rev. 0.0, 08/11/94	SERAS	General Sampling		
2004	Sample Packing and Shipment, Rev. 1.0, 06/25/15	SERAS	General Sampling		
2005	Quality Assurance/Quality Control Samples, Rev. 0.0, 08/11/94	SERAS	General Sampling		
2006	Sampling Equipment Decontamination, Rev. 1.0, 12/28/15	SERAS	General Sampling		
2007	Groundwater Well Sampling, Rev. 1.0, 06/25/15	SERAS	General Sampling		
2043	Water Level Measurements, Rev. 1,1, 05/28/13	SERAS	Water Level		
2073	Submersible Pressure Transducers, Rev. 0.0, 05/15/15	SERAS	Water Level		
4001	Logbook Documentation, Rev. 0.0, 07/02/02	SERAS	Site Activities		
4005	Chain of Custody Procedures, Rev. 2.0, 01/20/16	SERAS	General Sampling		

SOPs can be found at: https://www.epaosc.org/site/site_profile.aspx?site_id=2107

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment/ Instrument	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
In-Situ Level Troll 700 Transducer	Factory calibrated	Keep batteries charged	Field performance	Visual inspection	At time of use	Depth of submergence equals water column height	Send to manufacturer for repair and calibration	SERAS	Manufacturer's manual
Water Level Indicator	N/A	Equipment Check	Battery Test. Immersion Test.	N/A	Immediately before transporting to field	Buzzer and light activate	Replace battery or trouble shoot according to manufacturer's operating instructions.	Sampling personnel	SERAS SOP #2043

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21)
http://www.epaosc.org/site/site_profile.aspx?site_id=2107

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
EPA Region 2 SOP #C-89	Analysis of Volatile Organic Compounds in Aqueous and Waste Oil/Waste Organic Solvent Samples by Purge and Trap	Definitive	VOC	GC/MS	EPA Region 2 DESA	No
CLP SOM02.2	USEPA Contract Laboratory Program Statement of Work for Multi-Media, Multi-Concentration Organic Analysis; October 2006	Definitive	VOC	GC/MS	CLP	No

http://www2.epa.gov/clp

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/MS	See SOP #C-89	Initial calibration: performed if the calibration verification technical acceptance criteria have not been met. Calibration verification: Once every 12 hours	Initial calibration/ Continuing calibration: relative response factor (RRF) greater than or equal to minimum acceptable response factor listed in procedure; %RSD must be less than or equal to value listed in procedure	Initial calibration: inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate. Continuing calibration: inspect system, recalibrate the instrument, reanalyze samples.	DESA Laboratory GC/MS Analyst	SOP #C-89
GC/MS	See SOM02.2	Initial calibration: upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met. Continuing calibration: Once every 12 hours	Initial calibration/ Continuing calibration: relative response factor (RRF) greater than or equal to minimum acceptable response factor listed in Table 5 of procedure; %RSD must be less than or equal to value listed in Table 5 of procedure.	Initial calibration: inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate. Continuing calibration: inspect system, recalibrate the instrument, reanalyze samples.	EPA CLP RAS Laboratory GC/MS Technician	SOM02.2

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	Acceptable re-calibration; see SOM02.2 or EPA Method 8260C or EPA Method 8270D	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	EPA CLP RAS Laboratory GC/MS Technician/ DESA Laboratory GC/MS Analyst	SOM02.2/ EPA Region 2 SOP #C-89

[1]Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23)

QAPP Worksheet #26
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization: SERAS/ERT personnel
Sample Packaging (Personnel/Organization: SERAS/ERT personnel
Coordination of Shipment (Personnel/Organization): SERAS personnel
Type of Shipment/Carrier: Overnight delivery service or hand deliver
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodian at designated laboratory (OSCAR personnel for DESA Laboratory)
Sample Custody and Storage (Personnel/Organization): Sample Custodian at designated laboratory (OSCAR personnel for DESA Laboratory)
Sample Preparation (Personnel/Organization): EPA Region 2 DESA or CLP sample technicians
Sample Determinative Analysis (Personnel/Organization): EPA Region 2 DESA or CLP sample technicians
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples to be shipped on day of collection and arrive at laboratory within 24 hours (1 day) of collection
Sample Extract/Digestate Storage (No. of days from extraction/digestion): As per analytical method
Biological Sample Storage (No. of days from sample collection): Not applicable
SAMPLE DISPOSAL
Personnel/Organization: EPA Region 2 DESA or CLP sample technicians
Number of Days from Analysis: Per EPA Region 2 (60 days) or CLP guidelines

QAPP Worksheet #27
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Chain of custody records will be generated for all samples submitted for analysis per SERAS SOP #4005, *Chain of Custody Procedures*. Each sample will be individually labelled. Sample containers will be placed into bubble-wrap storage bags and then into a shipping cooler with the corresponding COC record. The lid of each shipping cooler will be secured with clear tape and custody seals. Samples will be shipped to the appropriate laboratory via overnight delivery service or hand delivered. For the CLP laboratory, refer to US EPA Office of Solid Waste and Emergency Response (OSWER) 924.0-44, EPA 540-R07-06 *Contract Laboratory Program Guidance for Field Samplers*, July 2007. EPA/ERT Scribe software will be used for sample management, as well as, generation of sample documentation, such as, labels and COC records. All COC records will be peer reviewed prior to shipment of samples in accordance with SERAS SOP # 4005, *Chain of Custody Procedures.* Samples will be shipped within 48 hours of sampling for next-day delivery under COC to the appropriate laboratory in accordance with SERAS SOP #2004, *Sample Packing and Shipment.* Procedures outlined in SOP #2002, #2003, and #2004 will be applied (refer to Worksheet #21).
Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): A sample custodian at the laboratory will accept custody of the shipped samples, and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory manager for corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. At this time, no samples will be archived at the laboratory.
Sample Identification Procedures: Sample identifications will conform to SERAS SOP #2002, *Sample Documentation*. If samples are shipped to a CLP laboratory, each groundwater sample will be identified with a unique CLP identification number provided by the EPA Region 2 Regional Sample Center Control (RSCC) for analysis. The appropriate CLP sample number will be listed on the label of every sample container collected at a given location. The sample numbers will be entered in the site EPA/ERT Scribe database.
Chain-of-custody Procedures: Refer to SERAS SOP #4005, *Chain of Custody Procedures*

QAPP Worksheet #28-1
QC Samples Table

Matrix	Groundwater
Analytical Group	VOC
Concentration Level	Low (µg/L)
Sampling SOP(s)	SERAS SOP #2007
Analytical Method/SOP Reference	EPA Region 2 SOP #C-89
Sampler's Name	Jean Bolduc
Field Sampling Organization	SERAS
Analytical Organization	EPA Region 2 DESA Laboratory
No. of Sample Locations	34

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per extraction batch of 20 samples	< RL	Investigate source of contamination	EPA Region 2 DESA Laboratory personnel	Sensitivity Contamination	< RL
Tuning	12 hr period	Pass all PBFB tune criteria	Check instrument, reanalyze, retune	EPA Region 2 DESA Laboratory personnel	Sensitivity	Pass all PBFB criteria
Initial Calibration	SOP #C-89	% RSD +/- 35% Not more than 10% of total analytes failure % D not more than 60%	Check instrument, reanalyze	EPA Region 2 DESA Laboratory personnel	Accuracy/Precision	% RSD +/- 35% Not more than 10% of total analytes failure % D not more than 60%

QAPP Worksheet #28-1
QC Samples Table

Matrix	Groundwater
Analytical Group	VOC
Concentration Level	Low (µg/L)
Sampling SOP(s)	SERAS SOP #2007
Analytical Method/SOP Reference	EPA Region 2 SOP #C-89
Sampler's Name	Jean Bolduc
Field Sampling Organization	SERAS
Analytical Organization	EPA Region 2 DESA Laboratory
No. of Sample Locations	34

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Continuing Calibration Check Standard	1 per analytical batch of 20 samples	Max % D for each analyte's RRF ± 30% of ICAL Not more than 10% of total analytes failure %D not more than 60% for any analyte otherwise rerun	Reanalyze, qualify data	EPA Region 2 DESA Laboratory personnel	Accuracy	Max % D for each analyte's RRF ± 30% of ICAL Not more than 10% of total analytes failure %D not more than 60% for any analyte otherwise rerun
Trip Blank	1 per cooler containing VOC samples	Client Defined	Investigate source of contamination	EPA Region 2 DESA Laboratory Personnel	Sensitivity Contamination	
LCS/LFB	2 per extraction batch of 20 samples	Limits: Average Recovery 70-130% %RPD < 20	Qualify data unless high recovery and/or Not Detected	EPA Region 2 DESA Laboratory Personnel	Accuracy/Precision	Limits: Average Recovery 70-130% %RPD < 20

QAPP Worksheet #28-1
QC Samples Table

Matrix	Groundwater
Analytical Group	VOC
Concentration Level	Low (µg/L)
Sampling SOP(s)	SERAS SOP #2007
Analytical Method/SOP Reference	EPA Region 2 SOP #C-89
Sampler's Name	Jean Bolduc
Field Sampling Organization	SERAS
Analytical Organization	EPA Region 2 DESA Laboratory
No. of Sample Locations	34

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Matrix Spikes	1 per extraction batch of 20 samples	Table 4 of SOP #C-89 Compound specific (full range -17 to 259%)	Qualify data unless high recovery and/or Not Detected	EPA Region 2 DESA Laboratory personnel	Accuracy	Table 4 of SOP #C-89 Compound specific (full range 17 to 259%)
Internal Standards	Each sample, standard, blank	Factor of two (-50% to +100%) from the initial/continuing calibration	Check instrument, analyze, qualify data	EPA Region 2 DESA Laboratory personnel	Quantitation	Factor of two (-50% to +100%) from the initial/continuing calibration
Surrogates	Each sample, standard, blank	Limits: 70-130%	Reinject, qualify data	EPA Region 2 DESA Laboratory personnel	Accuracy/Extraction Efficiency	Limits: 70-130%

QAPP Worksheet #28-2
QC Samples Table

Matrix	Aqueous (Groundwater)
Analytical Group	VOC
Concentration Level	Trace/Low (ug/L)
Sampling SOP(s)	2001
Analytical Method/SOP Reference	SOM02.2
Sampler's Name	Jean Bolduc
Field Sampling Organization	SERAS
Analytical Organization	EPA CLP RAS Laboratory
No. of Sample Locations	TBD

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Method Blank	1 every 12 hours	No analyte > CRQL*		Suspend analysis unit source recertified	EPA CLP RAS Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*	
Matrix Spike (Not Required)	1 per ≤ 20 samples; if requested	1,1-Dichloroethene	61-145 %R	Flag outliers	EPA CLP RAS Laboratory GC/MS Technician	Accuracy	1,1-Dichloroethene	61-145 %R
		Benzene	76-127 %R				Benzene	76-127 %R
		Trichloroethene	71-120 %R				Trichloroethene	71-120 %R
		Toluene	76-125 %R				Toluene	76-125 %R
		Chlorobenzene	75-130 %R				Chlorobenzene	75-130 %R
Matrix Spike Duplicate (Not Required)	1 per ≤ 20 samples; if requested	1,1-Dichloroethene	0-14 %RPD	Flag outliers	EPA CLP RAS Laboratory GC/MS Technician	Precision	1,1-Dichloroethene	0-14 %RPD
		Benzene	0-11 %RPD				Benzene	0-11 %RPD
		Trichloroethene	0-14 %RPD				Trichloroethene	0-14 %RPD
		Toluene	0-13 %RPD				Toluene	0-13 %RPD
		Chlorobenzene	0-13 %RPD				Chlorobenzene	0-13 %RPD
Deuterated Monitoring Compounds	all samples	Vinyl chloride-d3	65-131 %R	Check calculations and instruments, reanalyze affected samples	EPA CLP RAS Laboratory GC/MS Technician	Accuracy	Vinyl chloride-d3	65-131 %R
		Chloroethane-d5	71-131 %R				Chloroethane-d5	71-131 %R

*with the exception of methylene chloride, 2-butanone and acetone which can be up to 2 times the CRQL, or in some situations may require these compounds be up to 4 times the CRQL.

QAPP Worksheet #28-2
QC Samples Table

Matrix	Aqueous (Groundwater)
Analytical Group	VOC
Concentration Level	Trace/Low (ug/L)
Sampling SOP(s)	2007
Analytical Method/SOP Reference	SOM02.2
Sampler's Name	Jean Bolduc
Field Sampling Organization	SERAS
Analytical Organization	EPA CLP RAS Laboratory
No. of Sample Locations	TBD

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Deuterated Monitoring Compounds [cont'd]	all samples	1,1-Dichloroethene-d2	55-104 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet recovery limits	EPA CLP RAS Laboratory GC/MS Technician	Accuracy	1,1-Dichloroethene-d2	55-104 %R
		2-Butanone-d5	49-155 %R				2-Butanone-d5	49-155 %R
		Chloroform-d	78-121 %R				Chloroform-d	78-121 %R
		1,2-Dichloroethane-d4	78-129 %R				1,2-Dichloroethane-d4	78-129 %R
		Benzene-d6	77-124 %R				Benzene-d6	77-124 %R
		1,2-Dichloropropane-d6	79-124 %R				1,2-Dichloropropane-d6	79-124 %R
		Toluene-d8	77-121 %R				Toluene-d8	77-121 %R
		trans-1,3-Dichloropropene-d4	73-121 %R				trans-1,3-Dichloropropene-d4	73-121 %R
		2-Hexanone-d5	28-135 %R				2-Hexanone-d5	28-135 %R
		1,4-Dioxane-d8	50-150 %R				1,4-Dioxane-d8	50-150 %R
		1,1,2,2-Tetrachloroethane-d2	73-125 %R				1,1,2,2-Tetrachloroethane-d2	73-125 %R

QAPP Worksheet #28-2
QC Samples Table

Matrix	Aqueous (Groundwater)
Analytical Group	VOC
Concentration Level	Low (ug/L)
Sampling SOP(s)	2007
Analytical Method/SOP Reference	SOM02.2
Sampler's Name	Jean Bolduc
Field Sampling Organization	SERAS
Analytical Organization	EPA CLP RAS Laboratory
No. of Sample Locations	TBD

Lab QC Sample:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**		**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**	
Deuterated Monitoring Compounds [cont'd]	all samples	1,2-Dichlorobenzene-d4	80-131 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet recovery limits	EPA CLP RAS Laboratory GC/MS Technician	Accuracy	1,2-Dichlorobenzene-d4	80-131 %R
Internal Standards	all samples	60-140%		Check calculations and instruments, reanalyze affected samples	EPA CLP RAS Laboratory GC/MS Technician	Accuracy	± 40 % of response area, ± 20 sec retention time shift	

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records	On-Site Monitoring & Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
COC records Sample Labels Custody Seals Groundwater Sampling Field Sheets Scribe database Field Logbook – water levels and sample times Request Forms and Associated Correspondence Automated OSCAR Logs Laboratory sample identification numbers Photodocumentation Field Change Form (if necessary)	Photographs	Instrument run logs Sample extraction logs Sample digestion logs Preventative maintenance logs Instrument printouts Internal COC records Temperature logs Standard receipt logs Standard prep logs Data Reduction/Data Review records Analytical Results	Peer review records ESAT Data Validation Report UFP-QAPP Verification Checklist	Amended Work Plan Revised QAPP Trip Report Scribe Database

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Aqueous	VOC	Low	See Worksheet #18	SOP #C-89	7 days for preliminary data, 28 days for final data	EPA Region 2 DESA Laboratory	NA
Aqueous (Backup Laboratory)	VOC	Trace/Low	See Worksheet #18	SOM02.2	14 days for preliminary data, 42 days for final data	CLP assigned laboratory	NA

NA = Not applicable

QAPP Worksheet #31
Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Internal Audit	Monthly	Internal	DESA Laboratory	Lab QA Officer	Lab QA Officer	DESA Laboratory Personnel	DESA Laboratory QA Officer
Laboratory Technical Systems/Performance Audits	NA	External	Regulatory Agency	Regulatory Agency	EPA CLP RAS Laboratory	EPA CLP RAS Laboratory	EPA or other Regulatory Agency
Performance Evaluation Samples	NA	External	Regulatory Agency	Regulatory Agency	EPA CLP RAS Laboratory	EPA CLP RAS Laboratory	EPA or other Regulatory Agency
On-Site Field Inspection	Annual	Internal	EPA	EPA/DESA/HWSS	EPA/DESA/HWSS	EPA/DESA/HWSS	EPA/DESA/HWSS
Proficiency Testing (PT)	Semi-Annual	External	NELAP	PT Provider	EPA Region 2 Lab personnel	EPA Region 2 Lab personnel	EPA Region 2 Lab QA Officer
NELAP	Every 2 years	External	FLDOH	NELAP	EPA Region 2 Lab QA Officer	EPA Region 2 Lab personnel	FLDOH

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Observations/ Deviations from Work Plan	Logbook	Jean Bolduc TL/SERAS	Immediately	Field Change Form	Jean Bolduc/TL - SERAS	Within 24 hours of change
Peer Review	In the deliverable	Jean Bolduc TL/SERAS	Prior to deliverable due date	Comments directly in the deliverable	Jean Bolduc/TL - SERAS	Prior to deliverable due date
Laboratory Technical Systems/Performance Audits	Audit Report	CLP	30 days	Letter	CLP	14 days
Performance Evaluation Samples	Electronic Report	CLP Laboratory	30 days	Letter or written report	CLP Laboratory	14 days
PT	Letter with PT failure indicated	Lab QA Officer	30 days after audit	Letter	Lab QA Officer	45 days after Corrective Action Report
NELAC	Audit Report	Lab Management	30 days after audit	Letter or written report	Lab QA Officer	30 days after receiving notification

QAPP Worksheet #33
QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Technical Report	Monthly	20th of the month following performance period	TL/SERAS	ERT Project Officer and WAM
QA Report	Quarterly	February, May, August, November	Deborah Killeen, QA/QC Officer/SERAS	ERT Project Officer and Quality Coordinator

QAPP Worksheet #34
Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Completeness Check	Review of planning documents, analytical data package, sampling documents and external reports, as applicable, using the UFP-QAPP checklist	Internal	SERAS TL
Laboratory analytical data package	Data packages will be reviewed/verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	External	CLP Laboratory EPA Region 2 DESA Laboratory
	Reviewed for measurement performance criteria	External	ESAT Data Validation Team
Trip Report	Deliverable will be reviewed to verify transcription errors are not present	Internal	SERAS peer review team

QAPP Worksheet #35
Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Ensure that the sampling methods/procedures outlined in the QAPP were followed and any deviations noted	SERAS TL, WAM
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	ESAT Data Validation Personnel, EPA Region 2 DESA Laboratory Personnel, ERT WAM
IIa	Chains of custody	Examine COC forms against QAPP and laboratory contract requirements (e.g., analytical methods, sample identification, etc.).	CLP Analysts, ESAT Data Validation Personnel, EPA Region 2 DESA Laboratory Personnel SERAS TL
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	CLP Analysts, ESAT Data Validation Personnel, EPA Region 2 DESA Laboratory Personnel
IIb	Laboratory data package	Determine potential impacts from noted/approved deviations, in regard to PQOs. Examples include PQLs and QC sample limits (precision/accuracy).	ESAT Data Validation Personnel, EPA Region 2 DESA Laboratory Personnel
IIb	Field duplicates	Compare results of field duplicate (or replicate) analyses with RPD criteria	SERAS TL ERT WAM

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa/IIb	Groundwater	VOC	Low	SOP #C-89, *Analysis of Volatile Organic Compounds in Aqueous and Waste Oil/Waste Organic Solvent Samples by Purge and Trap GC/MS*	EPA Region 2 DESA Laboratory Personnel
IIa/IIb	Groundwater	VOC	Low/Medium	SOP #HW-33, *Low/Medium Volatile Data Validation,* Revision 3	ESAT Data Validation Personnel, EPA Region 2 Data Validation Personnel
IIa/IIb	Groundwater	VOC	Trace	SOP #HW-34, *Trace Volatile Data Validation*	ESAT Data Validation Personnel, EPA Region 2 Data Validation Personnel

http://pubweb.epa.gov/region2/qa/documents.htm

☑ Worksheet Not Applicable (State Reason) EPA Region 2 will be responsible for assessing the usability of the data.

QAPP Worksheet #37
Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:
Describe the evaluative procedures used to assess overall measurement error associated with the project:
Identify the personnel responsible for performing the usability assessment: Region 2
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

APPENDIX A
EPA Region 2 SOP #C-89
Analysis of Volatile Organic Compounds in Aqueous and Waste Oil/Waste Organic Solvents Samples
By Purge and Trap GC/MS
May 2016

STANDARD OPERATING PRECEDURE

ANALYSIS OF VOLATILE ORGANIC COMPOUNDS IN AQUEOUS AND WASTE OIL/WASTE ORGANIC SOLVENTS SAMPLES BY PURGE AND TRAP GC/MS

Signature and Title

Prepared by:	John Lee, Chemist, OICS	12/8/14 Date
Peer Reviewed by:	Nicholas Mendola, Environmental Scientist, OICS	12/8/14 Date
QA Reviewed by:	Sumy P. Cherukara, QAO, Laboratory Branch	12/8/14 Date
Approved by:	Gregory J. Santacroce, Section Chief, OICS	12/8/14 Date
Approved by	John Bourbon, Chief, Laboratory Branch	12/9/14 Date

Review

Reviewed by:	Signature	Date
Reviewed by:	Signature	Date

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 2
DIVISION OF ENVIRONMENTAL SCIENCE AND ASSESSMENT
LABORATORY BRANCH

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1. Scope and Application

The analytical SOP that follows is designed to analyze water, waste oil and non-aqueous phase liquid from hazardous waste sites for the organic compounds on the target analyte list in Table 1. This SOP is based on 40 CFR Method 624.

This SOP can be used to quantify most volatile organic compounds that have boiling points below 200° C and are insoluble or slightly soluble in water. The reporting limits are 5.0 ug/L for water, except for Ketones which are 10 ug/L. See Table 1 for a list of compounds, retention times, and their characteristic ions that have been evaluated on a purge-and-trap GC/MS system.

2. Summary of Method

2.1 Aqueous Samples

A 5mL aliquot of water or waste water containing internal and surrogate standards is purged with helium via purge-and trap apparatus and collected on a VOCARB3000/K trap.

2.2 Waste Oils and Waste Organic Solvents Samples (NAPLs)

A measured amount of waste oil or non-aqueous phase liquids is extracted with methanol. A portion of the methanol extract is diluted to 5mL with reagent water containing internal and surrogate standards, is purged with helium via purge and trap apparatus and collected on a tenax/silica gel column.

2.3 Analysis

The trap is heated. The volatile organics are then desorbed into a helium carrier gas and collected on a gas chromatographic column. The GC column is temperature programmed to separate the analytes, which are then detected with a mass selective detector (MSD). Qualitative identification of target analytes is accomplished by using the retention time and relative abundance of characteristic masses (m/z). Quantitation is performed by the

data system.

3. Definitions

See SOP #G-15 for definitions. Additional definitions-for terms not included in G-15 may be found on Appendix 1.

4. Interferences

4.1 Method Interferences

Spurious chromatographic peaks from glassware, reagents or equipment may be present in the chromatogram of the sample extract. Impurities in the purge gas, organic compounds outgassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for a majority of contamination problems.

4.2 Matrix Interferences

Compounds present in the sample with similar retention times and common ions may interfere with the compounds of interest. To eliminate interferences from equipment or reagents, a laboratory method blank is analyzed every 12 hours samples are to be analyzed. The blank should be analyzed before the samples but after the calibration curve/check standard and BS/BSDs.

4.3 Cross Contamination

Cross contamination can occur whenever high-concentration and low-concentration samples are analyzed sequentially. To reduce carryover, the purging device and sampling syringe must be rinsed with reagent water between sample analysis. For samples containing large amounts of water-soluble materials, suspended solids, high-boiling compounds, or high purgeable levels, it may be necessary to wash out the purging device with a detergent solution between analyses, rinse it with distilled water, per SOP G-13, section 9.2. The trap and other parts of the system are also subjected to contamination; therefore, frequent bakeout and purging of the entire system may be required.

4.3.1 Field Blank - To eliminate the interference caused by the diffusion of volatile organic into the sample during shipment & storage, a field reagent blank/trip blank is prepared by field personnel from "organic free" water and carried through the sampling & handling activities, is also analyzed for contamination.

5. Safety

5.1 The toxicity and carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds should be minimized by good laboratory practices, e.g. wear proper protective equipment, safety glasses, gloves, lab coat and working inside hoods whenever possible.

5.2 Refer to the Edison Facility Safety Manual Region II Part 2 – Laboratory Safety and Appendices 13/13A - Chemical Hygiene Plan for specific guidelines. The manual is available on the Region II Intranet. A hard copy is available in the Laboratory Office Area.

5.3 For detailed explanations consult the Material Safety Data Sheets (MSDS), available in the Laboratory Office area. MSDS are also electronically available.

5.4 The following analytes covered by this method have been tentatively classified as known or suspected mammalian carcinogens: Benzene, Carbon Tetrachloride, Chloroform, Vinyl Chloride, and Methylene Chloride.

6. Apparatus & Equipment

6.1 Gas Chromatography

The gas chromatography (GC) system unit must be capable of temperature programming and have a flow controller that maintains a constant column flow rate throughout desorption and temperature program operations. The system must include or be interfaced to a purge and trap system, and have all required accessories including syringes, analytical columns, and gases. All GC carrier gas lined must be constructed from stainless steel or copper tubing. Non-PTFE thread sealants, or flow controllers with rubber components are not to be used.

6.2 GC column

The GC column is a fused silica column with the following characteristics. The specific column and manufacturer are for illustration only; equivalent columns are available from other suppliers.

Manufacturer : J&W Scientific, P/N 121-1324
Length : 20 meters
Inside diameter: 0.18 millimeter

6.3 Mass Spectrum Detector (MSD)

The MSD will scan from 35 to 260 amu every 1 sec or less, using 70 volts (nominal) electron energy in the electron impact ionization mode. The MSD must be capable of producing a mass spectrum for Para-Bromofluorobenzene (PBFB) which meets the criteria in Table 2 when 2 uL of the GC/MS tuning standard is injected or purged through the GC (50ηg of PBFB).

6.4 Data System

The Data System is interfaced to the gas chromatograph and the mass spectrometer. The system allows the continuous acquisition and storage of data coming from these two entities during an analytical run. The Data System uses computer software that plots ion abundances of specific masses versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). The software also integrates the abundances in any EICP between specified retention time windows. All these data and information for a given analytical run is grouped into a datafile.

6.5 Concentrator / Autosampler

Tekmar purge and trap concentrator, model 3100 or equivalent with an autosampler unit, model Solatek-72 or equivalent. The outlet from this concentrator is connected to the GC injection port.

The trap used is the K-trap (Vocarb3000) which is purchased from Tekmar or equivalent supplier. The trap is replaced when bromoform and gases determinations become erratic.

6.6 Miscellaneous

The following Apparatus and materials are used for sample analyses:

- Syringes-10 uL to 1000 uL capacity with fixed needle, Hamilton or equivalent. Syringes - mL - 5mL Hamilton or equivalent, equipped with a Luer lock valve, Becton-Dickinson or equivalent.
- Laboratory convection oven capable of holding temperature of 105^{o}C and having internal dimensions of about 2 feet by 2 feet by 2 feet.
- Vials crimp top, Teflon sealed, 1mL, 5mL, 10mL, 15mL, manufactured by Wheaton Inc., or equivalent supplier.
- Aluminum crimp tops and Teflon/Silicone septa for 1mL, 5mL, and 15mL vials, manufactured by Pierce Inc., or equivalent supplier.
- Pasteur Pipets: Disposable
- Volumetric flasks
- pH Paper
- balances- analytical, capable of weighing 0.0001g, and a top-loading balance capable of weighing 0.01g - 100 g. The balances must be calibrated with class *s* weights or known reference weights at a minimum of once per month. The balance must also be annually checked by a certified technician.
- 40 ml teflon screw-top vials.

7. Reagents and Solutions Preparation

All purchased and prepared standards and reagents are recorded in Element which assigns a unique ID# to each. All containers must be labeled with the Name, ID#, concentration, preparation date and expiration date (where applicable). Please refer to SOP # G-9 for details.

7.1 Reagents

Reagents are generated at the laboratory facilities.

7.1.1 Reagent Grade Water - Organic free water demonstrated to be free of target analytes. A water purification system (Millipore Super-Q or equivalent) may be used to generate reagent grade water. An inert gas such as nitrogen or helium is bubbled through the water for between 30

and 60 min. as an additional precaution to rid it of volatile contaminants.

7.1.2 Methanol - As a dilution solvent, purge and trap grade.

7.2 Solution Preparation

All purchased and prepared standards and reagents are recorded in Element which assigns a unique ID# to each. All containers must be labeled with the Name, ID#, Concentration, preparation date and expiration date (where applicable. Please refer to SOP#G-9 for details.

7.2.1 Tuning Solution - Mass calibration standard, PBFB(25 ng/ul) : prepared from purchased concentrate in methanol. Store in a crimp top vial. 2 uL will be injected. The solution's expiration date is the same as the stock provided by the vendor.

7.2.2 Internal Standard/Surrogate Standard (IS/SS) Solution - The concentration and name of the components of the IS/SS solution are given below:

1,2-Dichloroethane-d_4(IS)	30 ug/ml
Fluorobenzene(IS)	30 ug/ml
Chlorobenzene-d_5(IS)	30 ug/ml
1,4-Difluorobenzene(SS)	100 ug/ml
2-Bromo-1-chloropropane(SS)	100 ug/ml
1,4-dichlorobutane(SS)	100 ug/ml
Ethyl acetate-C^{13}	100 ug/ml

(SS, for Pharmaceutical analyte analyses only)

Five µLs of this laboratory standard solution added to 5 mLs of water or sample extract provides a concentration of 30 µg/L of each internal standard and 100 µg/L of each surrogate standard.

7.2.3 Internal Standard (IS) Solution - The concentration and name of the components of the IS solution are given below:

1,2-Dichloroethane-d_4(IS)	30 ug/ml
Fluorobenzene(IS)	30 ug/ml
Chlorobenzene-d_5(IS)	30 ug/ml

7.2.4 Calibration and Verification Standard Solutions.

A calibration range of 5.0 to 200 ug/L consisting of at least three points and daily check standard of 50 ug/L is run. However, the calibration range and the concentration of the check standard may change due to project specific objectives. Working standard solutions are made from purchased stock standards or prepared in methanol from pure materials. They are stored in teflon/silicone vials. These solutions may be used up to three months from date of preparation. Each vial is to be marked with the date of first use.

Note: All Purgeable standards are to be prepared using Purge and Trap grade methanol.

Five µL of the above listed standards added to 5 mLs of reagent grade water (see sec 7.1.1) provides a concentration 50 ug/L of each analyte listed in the attached mixture list. For calibration aliquots and concentrations in 5 mLs of water see Section 10.2 on calibration.

7.2.5 LCS/LCSD (also known as an BS/BSD) - The LCS/LCSD should be prepared using a stock standard from a different vendor than the calibration standards. Working solutions are prepared in methanol from these stock solutions.

7.2.6 Matrix Spike Solution - The calibration stock solution in section 7.2.3 may be used to prepare the matrix spike solution.

7.2.7 Surrogate Spiking Solution- The concentration and name of the components of the solution are given below:

1,4-Difluorobenzene(SS)	100 ug/ml
2-Bromo-1-chloropropane(SS)	100 ug/ml
1,4-dichlorobutane(SS)	100 ug/ml

Note: These solutions may be used up to three months from date of preparation, or sooner if comparison with quality control check standard indicates a problem. Stock standards are transferred to a teflon capped vial for storage and protected from light at 10 to -20^{o} C. The IS/SS solution is stored at room temperature under

pressure on the instrument autosampler.

8. Sample Collection, Preservation, Storage, & Holding Time

8.1 Aqueous Samples

Samples are collected in the field and presented to the laboratory for analysis. The samples must be in 40mL Teflon-faced silicone rubber capped vials. They are stored at 4°C±2°C until analyzed. If samples contain air bubble(s) or head space, a case narrative would have to indicate the condition. All samples must be analyzed within 7 days of collection, unless preserved with hydrochloric acid, then the sample must be analyzed within 14 days of collection.

8.2 Waste Oil and Organic Waste Solvent (NAPLs)

These samples are collected in the field and stored at 4°C ±2°C until analyzed. NAPL have 14 days for extraction and analysis, unless the Section Chief determines the holding to be longer in case by case basis.

8.3 Drum samples do not have holding times and may be stored at room temperature.

Note: Criminal enforcement samples are locked up at all times in the criminal enforcement room.

9. Sample Preparation

Sample preparation is documented in the Sample Preparation Log Book (refer to SOP #G-9) and/or in Element Batch/Bench Sheets (refer to SOP #G-28).

NOTE: Choose the correct Element Batch/Bench Sheets for specific extraction template to use (i.e for NVOA – NPDES/SF; HAA, Pesticide-GC).

9.1 Aqueous Samples

There is no preparation for aqueous samples. They are ready for analysis after collection.

9.2 Waste Oils and Waste Solvents (NAPLs) Samples

With a clean Pasteur pipette, transfer and weigh 0.5g to 1.0g (based on the matrix) of sample into a clean 20 mL Teflon screw capped vial, using a top loading

balance with a tolerance of 0.1g. Add 9.5 mL of methanol and 0.5 mL of the surrogate spiking solution (7.2.7) into vial and immediately seal with a Teflon faced silicone/rubber septum and aluminum crimp top. Shake the vial for two minutes and allow the resultant slurry to settle (dry paint, glue, etc).

- Methanol Blank is prepared for NAPL sample by pipetting a 10 mL aliquot of purge grade methanol into the vial and immediately seal with a Teflon faced silicone/rubber septum and aluminum crimp top seal.

- Prepare MS for the NAPL samples, by adding 9.0 mL of methanol, 0.5 mL of the matrix spike solution, and 0.5 mL of surrogate solution to the aliquot of the sample chosen for spiking.

- In some cases, the final results of NAPL samples may be requested to be in "mg/L" instead of "mg/kg". Then we must convert the mg/kg values to mg/L by measuring the sample's density by using the formula below:

$$Density = \frac{Mass\,(g)}{Volume\,(mL)}$$

Pipet approximately 4 mL of the extract from either Sec. 9.2 or 9.3 into a GC vial for storage, using a disposable pipet, and seal the vial. The remainder of the extract may be discarded. Add 4 mL of methanol to a separate GC vial for use as the method blank.

The extracts must be stored at 4°C ± 2° C in the dark, prior to analysis.

1.0 ml of the extract is diluted to 50 ml with dd H_2O and then analysis can begin. QCs should be spiked with the solution in Sec. 7.2.2 and extracted QCs and samples should be spiked with the solution in Sec. 7.2.3. by the instrument before analysis begins.

10. Instrument Operating Conditions

GC/MS operating conditions (temperatures, carrier gas flow rates, etc.) will depend on

the instrument used for analysis. The conditions are set to allow for the detection of all desired analytes with "satisfactory" peak shapes and "resolution". Satisfactory means no excessive tailing, and good resolution means proper separation of adjacent analyte peaks.

10.1 Scan Parameters

The exact conditions of the GC/MS will depend on the condition of the MS source and GC column. Generally, the MS conditions are taken from the autotune results (or if necessary manual tune results) and will be shown by the PBFB mass calibration run. Scan parameters are as follows:

Mass range: 35 to 260 AMU
Electron multiplier voltage: Variable*
Number of A/D samples: 2 (variable)*
GC peak threshold: 1000 counts (variable)*
Threshold: 100 counts (variable)*

*Although these values are variable, they should not be changed without careful checking to see the effect on analyte detection and quantitation.

10.2 Tuning

The PBFB performance test requires the following instrumental parameters:

Electron energy:	70 volts nominal
Mass Range:	35 to 260 AMU
Scan time:	to give at least 5 scan per peak but not to exceed 7 seconds per scan

The test is performed by acquiring data from an injection of 50 ηg of PBFB in a suitable volume of solvent into the GC. After acquisition, a mass spectrum is obtained and compared with the criteria in Table 2.

10.3 GC Conditions

The GC conditions will be varied somewhat for different columns. The following are the recommended conditions:

Run time:	30.19 minutes
Scan start time:	3.80 minute
Injection port temperature:	200°C
Detector temperature:	280°C
Starting temperature:	40°C
Holding time at initial temperature:	4.0 minutes
Temperature program rate:	9 °C /min
Final Temperature:	220°C
	2 minute

10.4 Purge and Trap Device

The recommended (CFR method 624) purge and trap sampling cycle is as follows:

Carrier Gas:	Helium
Purge time:	11.0 minutes
Purge gas flow rate:	40 mL/min
Trap temperature:	30°C
Trap preheat temperature:	245°C
Desorb time:	2 minutes
Desorb temperature:	250°C
Trap bake out time:	10 minutes
Trap bake out temperature:	260°C

11. Sample Analysis

11.1 Analytical Sequence

At the beginning of each 12 hour period during which GC/MS analyses are to be performed, the system is tested to ensure that acceptable performance criteria are achieved for PBFB (see Sec. 14 for criteria).

11.2 Method Blank

A volatile method blank must be analyzed at the beginning of every 12-hr time period. A method blank consist of 5mL volume of reagent water, spiked with IS/SS. An acceptable method blank must contain <5 ppb for common contaminants (methylene chloride, ketones, toluene) and <3 ppb for non- common (see Section 14 for criteria).

11.3 Calibration of GC/MS equipment

11.3.1 Initial Calibration - The calibration solutions as prepared in section 7.2.3 contain the analytes routinely used to calibrate the instrument before analysis of samples (see Section 14 for criteria). A calibration curve is usually run only when a daily check standard, verifying the previous calibration curve, fails.

Analysis and quantitation of the calibration standard runs provide area counts for the quantitation mass of each analyte. These area counts are used to calculate the relative response factors (RRF)

$$RRF = \frac{(A_s)(C_{is})}{(A_{is})(C_s)}$$

according to the following equation:
where,

A_s = Area of the primary ion for the parameter to be measured
A_{is} = Area of the primary ion for the internal standard

C_{is}= Concentration of the internal standard
C_s = Concentration of the parameter to be measured

11.3.2 The occurrence of an unacceptable instrument response(s) from the analysis of calibration standards, e.g., unacceptable correlation coefficient or RSD of response factor(s), etc., is an indication of an analytical problem(s) with the selected calibration range for the analysis and must be corrected before sample analyses are conducted. Sample analysis may not proceed until the resulting calibration curve is fully acceptable according to the established criteria identified in this SOP.

Elimination of calibration point(s) from the calibration curve is an acceptable practice under the following special conditions:

11.3.2.1 In multi-analyte tests in which calibration solutions are prepared from mixtures, analyte concentrations analyzed reported or detected which are outside of the established calibration range for a given analyte, should not be included in the calibration for that analyte. This is an unavoidable situation because the stock solutions are mixtures.

11.3.2.2 A six point calibration curve with a concentration range of 5 to 200 ug/L is usually run. The calibration curve must have a minimum three concentration levels.

11.3.2.3 The lowest calibration point may be eliminated from the calibration curve. If this occurs, the Reporting Limit, which is based on the lowest calibration standard, must be raised accordingly and reflected in the final report.

11.3.2.4 The highest calibration point may be eliminated from the calibration curve if all sample concentrations and all associated quality control data (or their dilutions) are bracketed by the remaining calibration standard concentrations.

11.3.2.5 An outlier calibration point (other than a high point or a low point) may be eliminated only after an investigation has been performed and the reasons for the problem have been documented.

11.3.3 All analytical runs for the initial calibration must be made within a continuous 12 hour period.

11.3.4 A Continuing Calibration Verification as prepared in 7.2.3(CCV) is analyzed at the start of each 12 hour period samples are to be analyzed (except when a curve is run) to verify the accuracy of the calibration curve. A calibration curve generated from a newly prepared set of working standards must be verified by a second source (Sec. 7.2.4). No verifications are necessary for any subsequent generation of calibration curves from the same set of working standards. If a different source check standard fails to verify, then a 3rd source must be used. When a calibration curve is verified then one of its mid-points may be used to continuously calibrate the curve and become the CCV. The check standard RRF's are quantitated and the analyte responses compared with the average RRF of the calibration curve. Refer to Sec 14.3 for acceptance criteria.

11.3.5 Internal standard (IS) Response & Retention Time (RT)- The IS responses and RT standards must be evaluated during or immediately after data acquisition (see Section 14 for criteria).

11.3.6 In order to maintain a closed VOA analysis with minimum exposure, aqueous standards and QC samples can be prepared in VOA vials rather than using 50 mL volumetric flasks.

Any reference to preparation using 50 mL volumetric flasks can also use VOA vials based on 44 mL volume.
For Example, a typical initial calibration would be:
Amount of 50 ug/mL calibration standard added (uL):

STD CONC.	USING 50 mL volumetric	USING VOA Vial
5 ug/L	5	4.4
10 ug/L	10	8.8
20 ug/L	20	17.6
50 ug/L	50	44

100 ug/L	100	88
200 ug/L	200	176

11.4 BS/BSD (also known as an LCS/LCSD)

The BS/BSD/LCS/LCSD is analyzed in duplicate within 12 hour period samples are analyzed.

11.5 5 uL of IS/SS (7.2.2) must be added to all calibration standards, CCV, and BS/BSD/LCS/LCSD's.

11.6 Analysis of Water Samples

All water samples must be allowed to warm to ambient temperature before analysis.

Place the 40ml sample vials in the vial tray of the autosampler in an upright position with the caps on top and proceed with the analysis.

If the samples are analyzed after seven days, the pH of the sample must be determined. Once the sample aliquots have been taken from the VOA vial, test the pH by placing one or two drops of sample on the pH paper (do not add pH paper to the vial). Record the pH of the sample in the run log book.

In some cases, it is requested samples to be composited for analysis, in this case the following procedure is used:

a. A 50 ml volumetric flask and a 40 ml Teflon screw-top vial are used. The portion of each individual grab sample (in mL) to be included in the composite should be calculated by dividing the 50 mL by the number of individual grab samples to be included in the composite.

b. Starting with the first grab sample vial, insert the needle of a 5 mL syringe through the vials Teflon lined septum and draw the appropriate volume of sample (in mL) into the syringe. Transfer the sample from the syringe into the 50 mL volumetric flask. Repeat this procedure for all individual grab samples aliquots.Mix the contents of the volumetric flask and pour the content into the 40 mL vial and place on the autosampler.

c. The Matrix Spike (MS) is prepared by filling a 50 mL volumetric flask with sample and then spiking with the appropriate MS solution. The content of the volumetric is then transferred to the 40 mL vial and placed on the autosampler.

d. The autosampler will add 5 uL of the IS/SS solution (Sec. 7.2.2) into all aliquots transferred to the purge and trap concentrator.

11.7 Analysis of NAPL Samples

See Section 9.2 for NAPL preparation and for methanol blank preparation.

An aliquot of the diluted NAPL sample will be added into a 50 mL volumetric flask and fill with reagent grade water. The judgment of the analyst will determine the dilution factor.

Proceed with the analysis as outlined in section 11.6.

11.8 Analysis of TCLP Sample

Due to high regulatory levels, an initial dilution of 5X can be used for analysis. Further dilution may be required, based on the judgment of the analyst. If the TCLP sample is considered a water or NAPL sample, then section 11.6 or 11.7 should be followed for analysis.

The initial analysis of extracted NAPL TCLP samples will be performed using a dilution factor determined by the analyst. If in the judgment of the analyst, analyzing a less-diluted sample would cause system contamination, the results of the diluted analysis will be reported. Regulatory levels for TCLP are summarized in Table 7.

11.9 Run Log Book

Entries must be made in the run log book as the sample runs are made. These entries must include the following:

- date,
- survey name,
- laboratory sample number,

- computer file name,
- archived data file path to server,
- operator's initials, and
- method file name.

In the event of an erroneous entry, the entry line must be crossed out using a single line, initialed and dated by the analyst.

11.10 Instrument Logbook

Entries must be made in the Instrument Logbook (described in SOP #G-9) as sample runs are made. Refer to the Instrument Logbook for the entry of necessary information.

12. Qualitative Identification

Analytes are detected in the GC/MS run by the computer software by using criteria based on the expected retention time window and the characteristic mass ions for the individual analytes. Manual searches for required analytes and for other compounds can be performed by other procedures contained in the software programs.

12.1 Target Compounds

Qualitatively identify a sample component by comparing its mass spectrum (after background subtraction) to a reference spectrum (Note- the CCV analyzed on the same sequential run is used as the 'reference spectrum' for a group of samples and QC within a 12-hr. period with the same method. The CCV uses the previous CCV run as the reference spectrum of the same method. If a new method is generated and a curve is run for the first time or maintenance was done on the instrument, then the midpoint level of the curve is used as the reference spectrum for the subsequent sample analysis until the next CCV required is run).

Use the following criteria to confirm a qualitative identification:

The GC retention time of the sample component must be within 30 seconds of the time observed for the same compound found in the CCV.

All ions that are present above 10% relative abundance in the mass spectrum of the standard should be present in the mass spectrum of the sample component that

are located on Table 1 and should agree within absolute 20%. For example, if an ion has relative abundance of 30% in the standard spectrum, its abundance in the sample spectrum should be in the range of 10-50%. Some ions, particularly the molecular ion, are of special importance and should be evaluated even if they are below 10% relative abundance.

Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When GC peaks obviously represent more than one sample component (i.e., broadened peak with shoulders(s) or valley between two or more maxima), appropriate analyte spectra and background spectra can be selected by examining EICPs of characteristic ions for tentatively identified components. When analytes co-elute (i.e., only one GC peak is apparent), the identification criteria described in above paragraph can be met but each analyte's spectrum will contain extraneous ions contributed by the co-eluting compound.

Structural isomers that produce very similar mass spectra can be explicitly identified only if they have sufficiently different GC retention times. Acceptable resolution is achieved if the height of the valley between two isomer peaks is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

12.2 Non-Target Compounds (performed only upon request)

A library search must be executed for non-target sample components for the purpose of tentative identification. For this purpose, the most recent release of the NBS or Willey mass spectra library shall be used. Guidelines for making tentative identification are:

Up to 10 organic compounds of greatest concentration not listed in component list for the purge able organic compounds, excluding the system monitoring compound shall be tentative identified via a forward search of the NBS or Wiley Library. Substances with responses less than 10% of the internal standard are not required to be searched.

The relative intensities of major ions in the sample spectrum should agree within ±20% of the relative intensities of major ions in the reference spectrum. Molecular ions present in the reference must be present in the sample spectrum.

Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or co-elution.

Only after visual comparison of sample spectra with the nearest library spectrum will the analyst assign a tentative identification.

If a compound cannot be verified by the above criteria, then the analyst will report that identification as unknown and proceed with quantitation.

Computer generated library search routines should not use a normalization routine that would misrepresent the library or unknown spectra when compared to each other. Only after visual comparison of sample with the nearest library searches will the analyst assign a tentative identification. Analyst should use professional judgment to ensure spectra provided by library truly identifies the TIC. (Any Qual value less than 90, on the Library Search Compound Report, is not reported.)

13. Quantitative Analysis

The analytes identified in the sample must be quantified by the internal standard method. The EICP area of the characteristic ion designated as quantitative ion must be used. The average response factor from the multi-point initial calibration is used to calculate the amount of the compound in the sample.

It is expected that situations will arise where the automated quantitation procedures in the GC/MS software provide inappropriate quantitation. This normally occurs when there is compound co-elution, baseline noise, or matrix interferences. In these circumstances, the chemist must perform a manual quantitation.

When an analyte is detected and identified, it is quantitated by the software program by first calculating the integrated ion abundance of the quantitation mass as given in the identification file.

13.1 Target Compounds

The quantitation report generated by the software is examined to confirm that analytes present have been detected (i.e., no visible peaks missed), that identification has been made correctly (i.e., spectra are compared with known spectra), that integration has been performed correctly (e.g., the ion profile used for quantitation is satisfactory), and that baselines have been properly assigned.

Equation for aqueous samples: The concentration, in ug/L, is then calculated for water sample using equation below,

$$Conc\,(\mu g/L) = \frac{(A_x)(C_{is})(DF)}{(A_{is})(RRF)}$$

A_x = Area of the Characteristic ion for the compound to be measured
C_{is}= Amount of internal standard injected in ηg
DF = Dilution Factor
A_{is}= Area of the characteristic ion for the internal standard
RRF= The average RRF value obtained from the initial five point calibration

- Equation for NAPL samples are calculated by using the equations below:

$$Y = \frac{(W_s)(1mL)(V_x)}{(V_t)(1000\mu L)}$$

$$Z = \frac{(5mL)(DF)}{(Y)}$$

$$Conc(\mu g/kg) = \frac{(A_x)(C_{is})(Z)}{(A_{is})(RRF)}$$

13.2 Non-Target Compounds (performed only upon request)

Tentative Identified Compounds (T.I.C.'s) are defined as those compounds not contained in the initial calibration standard solutions, which therefore must be identified by the computer software, using the main spectra library. The computer software also quantitates the T.I.C. against the internal standard having the closest retention time to the retention time of the T.I.C. of interest. Total area counts from the total ion chromatograms are to be used for both the compound to be measured and the internal standard. A relative response factor (RRF) of one (1) is

to be assumed, using the equation shown in 13.1

Since T.I.C.'s are not calibrated all values are reported as estimated and flagged with the QA/QC remark code NJ. Only the 10 T.I.C.'s with the highest area counts are reported unless otherwise requested.

TICs are done for all Superfund projects.

13.3 Manual Integration

13.3.1 The compound identification and integration results generated by the EnviroQuant software may not always be accurate because of the reasons listed below:

- The automated integration routine may not find the target analyte as a result of retention time shift, co-eluting interference, or peak inappropriate (too high or too low) intensity.

- The target analyte peak area may be incorrectly integrated by the automated integration routine as a result of poor peak shape, co-elution with other peaks, or a significant baseline drift. Poor peak shapes can also be due to overloading of the GC column by the higher concentrations of calibration curve of certain analytes. The overloading can cause multiple peaks, shoulders, or humps which have the same spectra proving that they come from the same analyte. The lower concentrations of these analytes, however, do not exhibit the poor peak shape characteristics.

- If one or more peaks elute within the retention time window for a target analyte, the automated integration routine may not pick the peak with a retention time that best matches the retention time established by the calibration.

13.3.2 It is the analyst’s responsibility to validate the integration report generated by the computer software for every sample and calibration analysis. When errors are detected in the compound identification and peak integration, the analyst must conduct manual integration to correct the errors.

13.3.3 The manual integration must be reasonable, scientifically valid, and logically sound. The entire area of the subject peak and only the area of the subject should be integrated for that peak. Conducting peak-shaving to eliminate part of the subject peak or including peaks not belonging to the

subject peak is prohibited. Manual integration performed solely to meet the calibration and surrogate QC criteria is unacceptable.

13.3.4 Manual integrations must be documented in the following manner.

- Include the quantitation report and chromatogram for all samples and QC samples in the electronic data package.

- Submit summary quantitation reports prior to manual integration in the electronic data package. Also submit detailed quantitation report showing manually integrated target analytes, surrogates and / or internal standards.

- If manual integrations are done for reasons other than those listed in Sec. 13.3.1 then they must be initialed and dated by the analyst performing the integration on the quantitation report along with a brief narrative explaining why the manual integrations were required.

14. Quality Control

14.1 Tuning (TUN) - Sec 10.2

Acceptance Criteria - Ion abundances must be within the EPA acceptance criteria published in the 40 CFR Method 624. Refer to Table 2 for the BFB key ions and ion abundance criteria.

Corrective Action - If the criteria are not met, the instrument is retuned and BFB is reanalyzed.

14.2 Initial Calibration (CAL) - Sec 11.3

Acceptance Criteria - Table 3 lists the minimum RRF criteria that must be met and the maximum % RSD criteria for each individual VOA compound. In general, all RRF criteria must be greater than or equal to value listed in Table 3 at each concentration level with a maximum %RSD ±35%. The number of analytes not meeting the criteria in Table 3 must be 10% or less of the total analytes, the maximum %RSD should be not more than 60%. For NPDES analyses the number of NPDES analytes not meeting the criteria in Table 3 must be zero. As stated in Sec. 11.3.2.2 the calibration curve is usually 6 points (5-200 ug/L) but has a

minimum of 3 points.

Corrective Action - If more than 10% of the %RSD and RRF for the total analytes list fails (In the case of NPDES analyses if any NPDES analytes fails), or any analyte whose %RSD is >60, recalibration is required. If circumstances occur that prevent recalibration, (e.g. matrix interferences, holding time restrictions), consult with the Team Leader and/or Section Chief on appropriate action. Data may need to be flagged with the appropriate QA/QC remark codes listed in Table 5.

14.3 Continuing Calibration Verification (CCV), Sec 11.3)

Acceptance Criteria - All the compounds must be present in the quantitation report. The peak shape of the internal standard must be well defined and with a minimum degree of tailing. In general, all compounds must have a minimum RRF of what is listed in the Table 3. The maximum %D for each analyte's RRF must be ±30% of the average initial calibration RRF. Table 3 lists both the minimum RRF & maximum %D. The number of analytes not meeting the criteria in Table 3 must be less than 10% of the total analytes. The maximum %D must be less than 60. For NPDES analyses, all NPDES analytes must meet the criteria in Table 3.

Corrective Action - If %D of any analyte is more than 60, or if 10% of the total analytes or any NPDES analyte fails, then the CCV must be rerun. If it is still outside the acceptable range, the curve for that analyte should be reanalyzed. If there is a case where the CCV for a NPDES analyte (>30% but less than 60%) then the sample need not to be reanalyzed if that analyte was not identified in the affected samples. However if it is shown to be present, then the CCV and the affected samples must be reanalyzed for that analyte until the %D criteria is met. Also if a NPDES analyte fails the %D criteria biased low, the CCV must be reanalyze for that analyte until the %D criteria is met. Check with the section chief/team leader to determine whether further action is necessary to insure data quality. If reporting any analyte that failed the %D criteria (as long as it's less than 10% of the total analytes and value is less than 60) any associated data including non-detect (except where % D is high) should be qualified. Use the appropriate QA/QC remark codes in Table 6 when necessary.

14.4 Initial Calibration Verification (ICV) - The BS/BSD (Sec. 7.2.4) may serve as an ICV because it's made from a different source at a concentration close to the midpoint of the curve. It is processed through the analytical procedure the same

way as a CCV. If a separate source is not available then a second lot from the 1st source is acceptable. When a calibration curve is verified then one of its midpoints may serve as the CCV.
Acceptance Criteria and Corrective Action are same as 14.3.

14.5 Method Blank (BLK) (and 11.2)

Acceptance Criteria - A method blank is run every 12 hours that samples are run. The method blank should be processed in exactly the same manner as the samples. It should be clean without any contaminants, but if present, the concentration should be less than the reporting limit.

Corrective Action - Clean the instrument until analyses of method blanks show contaminants are under control. Common contaminants include methylene chloride, ketones, and toluene. Do not report as present any of the common contaminants if less than 10 times the amount reported in the blank. For all other analytes, do not report as present if less than five times the amount reported in the blank. If the amount is less than 10 or five times the amount found in the blank, report the amount found in the sample as a U value. If the contaminants found in the method blank are not in the sample then report the analytes (contaminants) as non-detect with the reporting limit as their values.

14.6 Surrogate Standards (Sur) (Sec 11.5)

Acceptance Criteria - Surrogate recoveries for each run are examined to confirm that they are within the acceptable range of 70-130%. (Ref. CERCLA CLP SOW for OLM04.3).

Corrective Action - If two surrogate standard recoveries are outside the QC limits in the blank or sample, corrective action is required. Begin by checking the GC/MS instrument for operation problems, correcting apparent instrument problems, and re-injecting the sample. The cause of problem must be determined and shall be corrected if feasible. If no correction is possible, the associated data, including the non-detect (except where the recovery is high the sample should not qualified) should be qualified. Use the appropriate QA/QC remark codes in Table 5, when necessary. If no instrument problems can be determined, consult with the Section Chief for course of action.

The associated data should be qualified as follows: If a surrogate does not meet

the acceptance limits, then all analytes quantitated on the same internal standard should be qualified. The exception to this rule is when dealing with data for a project of a non-regulatory program. The procedure then is to qualify the data according to similarities in chemistry. The analytes qualified will be those that have similar chemical properties as the affected surrogates. Use the appropriate QA/QC remark codes in Table 6, when necessary.

In the analysis of pharmaceutical analytes-Acetone, Methylene chloride, Ethyl acetate, Isopropyl acetate, and n-Amyl acetate, Ethyl acetate-C^{13} is used as one of the surrogates. If Ethyl acetate is detected in the analysis then its concentration must be corrected for by the percent recovery of this surrogate. For example if the % recovery of Ethyl acetate-C^{13} is 110, then the concentration of Ethyl acetate must be multiplied by 0.9. If Ethyl acetate is not detected and the % recovery of the surrogate is less than 100 but within the acceptance limit then no qualification of the analyte is necessary.

14.7 Internal Standards (ISTD) (Sec 11.5)

Acceptance Criteria - Internal standards (IS) areas examined to confirm reproducibility.

Corrective Action - If the area for any IS changes by more than a factor of two (-50% to +100%) the mass spectrometric system must be inspected for malfunction, and corrections made as appropriate and samples reanalyzed. If the results are the same, the sample should be qualified accordingly.

14.8 Matrix Spikes (LFM/MS) (Sec 11.6)

Acceptance Criteria - For every batch (a batch is defined as a group of samples of the same site/survey which behaves similarly with respect to the sampling or the testing procedures being employed. For QC purposes the number in a given batch is 20. If the number of samples in a group is greater than 20, then each group of 20 samples and those in excess of 20 will be handled as separate batches), one spiked field sample per batch is analyzed. Calculate percent recovery for all groups of compounds. For NPDES (National Pollution Discharge & Elimination System) samples, spike all analytes. Please refer to Table 6 of 40 CFR Method 624 for QC Acceptance Criteria. The spiking solution contains all target analytes and the spike level should be at the mid-level of the calibration curve or at the level of continuing calibration check. For oil samples, duplicates are done instead of a MS.

For samples analyzed under the NPDES, Drinking Water, RCRA and/or Criminal Enforcement programs, prepare one LFM/MS sample for each matrix per project for an analytical batch of 10 or less. For samples analyzed under other programs, e.g., Superfund, Ambient Water, prepare one LFM/MS per matrix for an analytical batch of 20 samples or less regardless of the number of different projects that comprise the analytical batch.

Corrective Action - Use the appropriate QA/QC remark codes for MS results which are outside the QA/QC acceptance limits.
The recovery of an analyte in the LFM/MS is not evaluated if the value of that analyte in the unfortified sample is greater than the level used to fortify the sample. No dilution for the analyte is necessary in the LFM/MS.

14.9 LCS/LCSD (BS/BSD) - (Sec 11.4)

Acceptance Criteria - For each batch of sample analyzed, a LCS/LCSD is analyzed in duplicate. Calculate percent recoveries and RPD. The average of the percent recoveries of the duplicates will be used. Percent recoveries are 70 to 130% and the RPD is 20.

Corrective Action -The BS/BSD has the same corrective action as the Check Standard (see Sec. 14.3) except not all EPA Method 624 analytes have to pass. However, the first BS/BSD analyzed after the generation of a new curve must have all its NPDES analytes passing %D and RRF criteria since it is serving as an initial calibration check. If an analyte is present in the sample and that analyte fails to meet the acceptance criteria in the one or both of the LCS/LCSD duplicates, the associated data, including the non-detects (except where the recovery is high) should be qualified. The sample data should be flagged with the appropriate QA/QC remark codes listed in Table 5.

15. METHOD PERFORMANCE

A demonstration of capability (DOC) should be performed each time there is a significant change in the chemistry of the method, a major modification to an existing instrument, or a new instrument is installed. A DOC is performed by each analyst designated to analyze samples using this method. An annual check must subsequently be performed and documented for each analyst using this method. If QC criteria provided in this method are not achieved, then corrective action(s) should be implemented. This may include sample re-analysis, as determined by existing laboratory policy and/or in consult with lab

management and QAO.

15.1 Accuracy and Precision

15.1.1 Demonstration of Capability

A demonstration of capability study was conducted for this method for each analyst using this method. The study consisted of the analysis of four standards which are from a source independent of the standard curve. The results of the standards must be within the acceptance criteria supplied by the manufacturer or within 30% if none are specified. The % RSD should be within 30%. The results of the accuracy and precision study (true value, % recovery, standard deviation and % RSD) are maintained by the Quality Assurance Officer for each analyst and are located in the Laboratory's Central File.

15.1.2 Continuing Demonstration of Capability

An annual continuing demonstration of capability study must be performed and documented. It may consist of either successfully analyzing a PT sample or analyzing four replicate LCS standards to within control limits as stated in section 15.1.1. The results of the continuing accuracy and precision study (true value, % recovery, standard deviation and % RSD or final report from the PT provider) are maintained by the Quality Assurance Officer for each analyst and are located in the Laboratory's Central File.

15.2 Method Detection Limit (MDL)

An MDL Study was conducted for this method. The study is based on the requirements listed in 40 CFR Part 136 Appendix B. Specific procedures for the analysis of seven replicate samples of the method fortified at a level between 2-3x the detection limit or the lowest point of the calibration curve. The results of the MDL determination (true value, average concentration, standard deviation and calculated MDL) are maintained by the Quality Assurance Officer for each method and are located in the Laboratory's Central File.

15.3 Limit of Quantitation (LOQ)

The Laboratory performs a Limit of Quantitation (LOQ) study on an annual basis for analytes associated with chemistry methods. The validity of LOQ is confirmed by successful analysis of an LCS at approximately 2X the reporting limit. The

recovery of each analyte is within the acceptance criteria established for the LCS (Sect. 14.9). After this study is completed, it is reviewed and approved by the Laboratory Management. A summary of all LOQ study performance is maintained in the Laboratory's Central File.

16. Reporting and Validation

16.1 Reporting Limits

The reporting limits are calculated based on the concentration of the lowest calibration standard analyzed. The reporting limits are matrix and dilution dependent. All reporting values should be rounded to 2 significant figures. The reporting limit is calculated by taking the lowest standard of the calibration curve using the appropriate equation from Section 13.1. Results for the sample that has the lowest dilution should be reported. All non-detects are reported as a reporting limit as described in Table 5.

16.2 Electronic Data Package (EDP)

Requirement for Electronic Data Packages is on G:\Laboratory_Branch\Electronic Data Packages\Requirements for EDP Packages.

16.3 Laboratory Information Management System (LIMS)

Note: Refer to SOP G-28 Analyst/reviewer sections

16.3.1 Data entry: Upload raw data into Element with DataTool. Verify the accuracy of the reported results from the instrument data, including unit conversion, reporting limit changes, dilution correction, TICs, etc.

16.3.2 Verify the contents of the Element reviewer checklist based on the method QC requirements.

16.3.3 The analyst completes the reviewer checklist. Sample QC can be automatically checked. Instrument QC is not automatically checked in the reviewer checklist. The analyst must record instrument QC checks manually in the reviewer checklist. Any QC outliers are obtained from within Element (ex. Data review screen) and/or from the instrument data. Anomalies must be addressed in the comment section of the reviewer

checklist by the Analyst.

16.4 Data Validation (see SOP G-26)

The analyst enters the results on the LIMS and the data package is given to a reviewer. The review is done by a peer who was not involved in the analysis. Upon completion of the review, including validation of all the appropriate codes in the LIMS for the particular project(s), the data reviewer will sign and date the QA/QC Checklist.

Analysts must include an example calculation on a sample for each method/matrix analyzed in all data packages and, if applicable, using a detect result. The calculation will begin with the sample result generated from the instrument and end with the result reported. It is the responsibility of the peer reviewer to verify the accuracy of the calculations performed.

The only exception to this policy would be if no data reduction/manipulation is performed on the sample results between the instrument output and final results reported.(that is to say if the sample results generated from the analyses is reported directly from the instrument). Also, for multi-analyte methods, one analyte needs to be carried through in the example calculation representing the group.

Once review is completed by the peer reviewer which is the final check off on the Reviewer Checklist, the peer reviewer, prints out the Reviewer Checklist and includes it to the Project folder.

17. Pollution prevention

17.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operation. The EPA has established a preferred hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the Agency recommends recycling as the next best option.

17.2 The quantity of chemicals purchased should be based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation

volumes should reflect anticipated usage and reagent stability.

17.3 For information about pollution prevention that may be applicable to laboratories and research institutions, consult "Less is Better: Laboratory Chemical and Management for Waste Reduction", available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th Street N.W., Washington D.C. 20036, (202)872-4477.

17.4 No solvents are utilized in this method except the extremely small volumes of methanol needed to make calibration standards and NAPL extractions. The only other chemicals used in this method are the neat materials in preparing standards and sample preservatives. All are used in extremely small amounts and pose no threat to the environment.

18. Waste Management

The USEPA requires that laboratory waste management practice be conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes should be characterized and disposed of in an acceptable manner. The agency urges laboratories to protect the air, water and land by minimizing and controlling all releases from hoods and bench operations, complying with the letter and spirit of any water discharge permit and regulations, and by complying with all solid and hazardous waste regulations, particularly the hazardous waste identification rules and land disposal restrictions. For further information on waste management consult the Region 2 SOP G-6, "Disposal of Samples and Hazardous Wastes in Regional Laboratory".

19. References

19.1 U.S. EPA 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of pollutants Under the Clean Water Act, Method 624, July 1, 1999.

19.2 EPA Contract Laboratory Statement of Work SOMO 1.2, June 2007.

19.3 SW-846 Method 8260C- Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), August 2006, Revision 3.

19.4 SW-846 Method 5035- Closed System Purge and Trap Extraction of Volatile Organics in Soil and Waste Samples December 1996, Revision 0.

19.5 Method 1666-Volatile Organic Compounds Specific to the Pharmaceutical Manufacturing Industry by Isotope Dilution GC/MS, Revision A, July, 1998

19.6 Promium Element Data System, Laboratory Information Management Systems, Promium, LLC. Current Version.

19.7 Laboratory Quality Management Plan (LQMP), U.S. Environmental Protection Agency, Region 2 Laboratory Branch. Current Version.

19.8 Environmental, Health and Safety Operations Manual & Chemical Hygiene Plan, EPA Region 2. Current Version.

19.9 SOP G-6 Disposal of Samples & Hazardous Waste and Chemical Inventory Management. Current Version.

19.10 SOP G-9, Laboratory Policy For The Establishment And Maintenance Of Logbooks Associated With Chemical Analysis. Current Version.

19.11 SOP G-26, Guidance for Laboratory Data Review Current Version

19.12 SOP G-28, Laboratory Operations using "Element" LIMS. Current Version

19.13 US EPA, Region 2, SOP G-15, Definitions, Current Version.

19.14 USEPA, Region 2, SOP G-13, Glassware Washing, Current Version.

19.15 US EPA, Region 2 SOP G-23, Percent Dry Solids, Current Version.

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APPENDIX I

DEFINITION OF TERMS

Analysis date/time - the date and military time of the injection of the sample, standard, or blank into the GC/MS or GC system.

4-Bromofluorobenzene (BFB) - compound chosen to establish mass spectral instrument performance for volatile analyses.

Day - unless otherwise specified, day shall mean calendar day.

Extracted Ion Current Profile (EICP)- a plot of ion abundance versus time (or scan number) for ion(s) of specified mass(es).

Narrative - a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

Percent Difference (%D) - is used to compare two values, the percent difference indicates both the direction and the magnitude of the comparison.

Percent Moisture - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105ºC. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at 105ºC, including water. Percent moisture may be determined from decanted samples and from samples that are not decanted.

Purge and Trap (Device) - analytical technique (device) used to isolate volatile (purgeable) organic by stripping the compounds from water or soil by a stream of inert gas, trapping the compounds on a porous polymer trap, and thermally desorbing the trapped compounds onto the gas chromatographic column.

Reagent Water - water in which target analytes are not observed at or above the minimum quantitation limits.

Reconstructed Ion Chromatogram (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatography; a plot of total ion current versus retention time.

Recovery - a determination of the accuracy of the analytical procedure made by comparing measured values for a fortified (spiked) sample against the known spike values. Recovery is determined by the following equation:

$$\%\ Recovery = \frac{Measured\ value}{Spiked\ value}\ X\ 100$$

Relative Percent Difference (RPD) - is used to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero.

Relative Response Factor (RRF) - a measure of the relative mass spectral response of an analytes compared to its internal standard. Relative response factor are determined by analysis of standards and are used in the calculation of concentration of analytes in

$$RRF = \frac{(A_x)(C_{is})}{(A_{is})(C_x)}$$

samples. RRF is determined by the following equation:

Where,

A = area of the characteristic ion measured
C = concentration
Is= internal standard
X = analytes of interest

Resolution - also termed separation, the separation between peaks on a chromatogram, calculated by dividing the depth of the valley between the peaks by the peak height of the smaller peak being resolved, multiplied by 100.

Sample Number (EPA Sample Number) - a unique identification number designated by EPA for each sample. The EPA sample number appears on the sample traffic report which documents information on the sample.

System Monitoring Compounds - compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard for volatile analysis, and used to evaluate the

performance of the entire purge and trap-GC/MS system. These compounds are deuterated compounds not expected to be detected in the environmental media.

Target Compound List (TCL) - a list of compounds designated by SOP for analysis.

Tentatively Identified Compounds (TIC) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds. Up to 10 peaks (those greater than 10% of peak areas or heights of nearest internal standards) are subjected to mass spectral library searches for tentative identification.

Time - when required to record time on any deliverable item, time shall be expressed as military time, i.e., a 24-hour clock.

Twelve-hour Time Period - The twelve (12) hour time period for GC/MS system instrument performance check, standards calibration (initial or continuing calibration), and method blank analysis begins at the moment of injection of instrument performance. The time period ends after 12 hours has elapsed according to the system clock.

Volatile Compounds - compounds amenable to analysis by the purge and trap technique. Used synonymously with purgeable compounds.

Wide Bore Capillary Column - a GC column with an internal diameter (ID) that is greater than 0.32 mm. Columns with lesser diameters are classified as narrow bore capillaries.

TABLE 1 - CHARACTERISTIC IONS FOR LISTED ANALYTES

Analyte	Analyte Program	Primary Ion	Secondary Ions	Internal Std. Used
1,2-Dichloroethane d_4 (ISTD #1)	N, S	65	67	
Chloromethane	N, S	50	52	1
Bromomethane	N, S	94	96	1
Vinyl Chloride	N, S	62	64	1
Chloroethane	N, S	64	66	1
Methylene Chloride	N, S, P	49	84	1, 2
Acetone	S, P	43	58	1, 2
Carbon disulfide	S	76	78	1
1,1-Dichloroethene	N, S	96	63	1
1,4 Difluorobenzene(SSTD #1)	N, S	114	63	2
1,1-Dichloroethane	N, S	63	65	1
Trans-1,2-Dichloroethene	N, S	96	61,98	1
Chloroform	N, S	83	85	1
2-Butanone[Methyl Ethyl Ketone]	S	43	57	1
1,2-Dichloroethane	N, S	62	64	1
1,1,1-Trichloroethane	N, S	97	99	1
Carbon Tetrachloride	N, S	117	119,121	1
Bromodichloromethane	N, S	83	85	2
1,2-Dichloropropane	N, S	63	65	2
1,3-Z-Dichloropropene (cis)	N, S	75	77	2
Trichloroethene	N, S	95	97,130	2
Fluorobenzene (ISTD #2)	N, S, P	96	-	
Benzene	N, S	78	77	2
1,3-E-Dichloropropene (trans)	N, S	75	77	2
1,1,2-Trichloroethane	N, S	97	83, 85	3
Dibromochloromethane	N, S	129	127, 131	3
2-Bromo-1-chloropropane (SSTD #2)	N, S, P	77	79	2
2-Hexanone	S	43	58	3
4-Methyl-2-Pentanone	S	43	58	2
Bromoform	N, S	173	171, 175	3
Tetrachloroethene	N, S	166	129, 131	3
1,1,2,2-Tetrachloroethane	N, S	83	85	3
1,4-Dichlorobutane (SSTD #3)	N, S	55	90	3
Chlorobenzene-d_5 (ISTD #3)	N, S	117		

Toluene	N, S	91	92	2
Chlorobenzene	N, S	112	114	3
Ethylbenzene	N, S	106	91	3
Styrene	S	104	78	3
Meta + Para-Xylene	S	91	106	3
Ortho-Xylene	S	91	106	3
Dichlorodifluoromethane	S	85	87	1
Trichlorofluoromethane	S,N	101	103	1
Methyl Acetate	S	43	74	1
Cis-1,2-Dichloroethene	S	96	61, 98	1
Cyclohexane	S	56	84, 41	1
Methylcyclohexane	S	83	--	2
1,2-Dibromoethane	S	107	--	3
Isopropylbenzene	S	105	120	3
1,3-Dichlorobenzene	N, S	146	148,113	3
1,4-Dichlorobenzene	N, S	146	148,113	3
1,2-Dichlorobenzene	N, S	146	148,113	3
1,2-Dibromo-3-Chloropropane	S	75	155,157	3
1,2,4-Trichlorobenzene	S	180	182	3
Ethyl Acetate	P	43	45, 70	2
Isopropyl Acetate	P	43	61, 87	2
n-Amyl Acetate	P	43	70	2
Acrylonitrile	N	53	52,51	1
1,1,2-Trichloro-1,2,2-trifluoroethane	S	101	85, 151	1
Methyl tert-butyl ether	S	73	74, 57	1
Bromochloromethane	S	128	130, 49	1
1,2,3-Trichlorobenzene	S	180	182	3

N=NPDES(EPA Method 624, Total Toxic Organics), S= Superfund(SOM01.1), P=Pharmaceuticals

Table 2 - BFB KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
50	15-40% of base peak
75	30-60% of base peak
95	base peak, 100% relative abundance
96	5-9% of base peak
173	less than 2% of mass 174
174	greater than 50% of base peak
175	5-9% of mass 174
176	greater than 95% & less than 101% of mass 174
177	5-9% of mass 176

Table 3 - INITIAL AND CONTINUING CALIBRATION CRITERIA FOR TARGET ANALYTES

Analyte	Analyte Program	Minimum* RF	Maximum % RSD	Maximum % D
Chloromethane	N, S	0.100	35	30
Bromomethane	N, S	0.100	35	30
Vinyl Chloride	N, S	0.100	35	30
Chloroethane	N, S	0.300	35	30
Methylene Chloride	N, S, P	0.100	35	30
Acetone	S, P	0.100	35	30
Carbon disulfide	S	0.300	35	30
1,1-Dichloroethene	N, S	0.300	35	30
1,1-Dichloroethane	N, S	0.300	35	30
Trans-1,2-Dichloroethene	N, S	0.300	35	30
Chloroform	N, S	0.300	35	30
2-Butanone[Methyl Ethyl Ketone]	S	0.100	35	30
1,2-Dichloroethane	N, S	0.300	35	30
1,1,1-Trichloroethane	N, S	0.300	35	30
Carbon Tetrachloride	N, S	0.300	35	30
Bromodichloromethane	N, S	0.100	35	30
1,2-Dichloropropane	N, S	0.100	35	30
1,3-Z-Dichloropropene (cis)	N, S	0.200	35	30
Trichloroethene	N, S	0.200	35	30
Benzene	N, S	0.300	35	30
1,3-E-Dichloropropene (trans)	N, S	0.300	35	30
1,1,2-Trichloroethane	N, S	0.100	35	30
Dibromochloromethane	N, S	0.200	35	30
2-Hexanone	S	0.100	35	30
4-Methyl-2-Pentanone	S	0.100	35	30
Bromoform	N, S	0.100	35	30
Tetrachloroethene	N, S	0.300	35	30
1,1,2,2-Tetrachloroethane	N, S	0.200	35	30
Toluene	N, S	0.300	35	30
Chlorobenzene	N, S	0.300	35	30
Ethylbenzene	N, S	0.300	35	30
Styrene	S	0.300	35	30
Meta + Para-Xylene	S	0.300	35	30

Ortho-Xylene	S	0.300	35	30
Dichlorodifluoromethane	S	0.300	35	30
Trichlorofluoromethane	S,N	0.300	35	30
Methyl Acetate	S	0.300	35	30
Cis-1,2-Dichloroethene	S	0.300	35	30
Cyclohexane	S	0.300	35	30
Methylcyclohexane	S	0.200	35	30
1,2-Dibromoethane	S	0.200	35	30
Isopropylbenzene	S	0.300	35	30
1,3-Dichlorobenzene	N, S	0.300	35	30
1,4-Dichlorobenzene	N, S	0.300	35	30
1,2-Dichlorobenzene	N, S	0.300	35	30
1,2-Dibromo-3-Chloropropane	S	0.020	35	30
1,2,4-Trichlorobenzene	S	0.200	35	30
Ethyl Acetate	P	0.100	35	30
Isopropyl Acetate	P	0.100	35	30
n-Amyl Acetate	P	0.100	35	30
Acrylonitrile	N	0.100	35	30
1,1,2-Trichloro-1,2,2-trifluoroethane	S	0.100	35	30
Methyl tert-butyl ether	S	0.100	35	30
Bromochloromethane	S	0.100	35	30
1,2,3-Trichlorobenzene	S	0.100	35	30
1,4-Difluorobenzene(SSTD)	N,S	0.300	35	30
2-Bromo-1-Chloropropane (SSTD)	P	0.300	35	30
1,4-Dichlorobutane(SSTD)	N,S	0.300	35	30
Ethyl Acetate-C^{13}(SSTD)	P	0.100	35	30

N=NPDES(EPA Method 624, Total Toxic Organics), S= Superfund(SOM01.1), P=Pharmaceuticals

∗Minimum RF values are an indicator of system integrity, secondary to other QA/QC requirements.

Table 4 -PERCENT RECOVERIES FOR MATRIX SPIKE

Analyte	% Recovery Water
Benzene	44-150
Bromodichloromethane	46-154
Bromoform	60-167
Bromomethane	26-242
Carbon Tetrachloride	76-137
Chlorobenzene	47-158
Chloroethane	26-213
Chloroform	52-136
Chloromethane	26-242
Dibromochloromethane	57-145
1,1-Dichloroethane	62-149
1,2-Dichloroethane	52-154
1,1-Dichloroethene	26-231
trans-1,2-Dichloroethene	56-155
cis-1,2-Dichloroethene	56-155
1,2-Dichloropropane	26-210
cis-1,3-Dichloropropene	26-227
trans-1,3-Dichloropropene	17-183
Ethylbenzene	46-160
Methylene Chloride	26-181

Analyte	% Recovery Water
1,1,2,2-Tetrachloroethane	47-146
Tetrachloroethene	68-147
Toluene	56-149
1,1,1-Trichloroethane	54-161
1,1,2-Trichloroethane	55-142
Trichloroethene	74-143
Vinyl Chloride	26-259
m & p-Xylene	46-160
o-Xylene	46-160
Styrene	46-160

All other compounds must meet a % recovery range 50-150.

Table 5 - REPORTING LIMITS

Analyte	Analyte Program	Water µg/L
Chloromethane	N, S	5µ
Bromomethane	N, S	5
Vinyl Chloride	N, S	5
Chloroethane	N, S	5
Methylene Chloride	N, S	5
Acetone	S	10
Carbon disulfide	S	5
1,1-Dichloroethene	N, S	5
1,1-Dichloroethane	N, S	5
Trans-1,2-Dichloroethene	N, S	5
Chloroform	N, S	5
2-Butanone[Methyl Ethyl Ketone]	S	10
1,2-Dichloroethane	N, S	5
1,1,1-Trichloroethane	N, S	5
Carbon Tetrachloride	N, S	5
Bromodichloromethane	N, S	5
1,2-Dichloropropane	N, S	5
1,3-Z-Dichloropropene (cis)	N, S	5
Trichloroethene	N, S	5
Benzene	N, S	5
1,3-E-Dichloropropene (trans)	N, S	5
1,1,2-Trichloroethane	N, S	5
Dibromochloromethane	N, S	5
2-Hexanone	S	10
4-Methyl-2-pentanone	S	10
Bromoform	N, S	5
Tetrachloroethene	N, S	5
1,1,2,2-Tetrachloroethane	N, S	5
Toluene	N, S	5
Chlorobenzene	N, S	5
Ethylbenzene	N, S	5
Styrene	S	5
Meta + Para-Xylene	S	5
Ortho-Xylene	S	5
Dichlorodifluoromethane	S	5

Trichlorofluoromethane	S,N	5
Methyl Acetate	S	5
Cis-1,2-Dichloroethene	S	5
Cyclohexane	S	5
Methylcyclohexane	S	5
1,2-Dibromoethane	S	5
Isopropylbenzene	S	5
1,3-Dichlorobenzene	N, S	5
1,4-Dichlorobenzene	N, S	5
1,2-Dichlorobenzene	N, S	5
1,2-Dibromo-3-Chloropropane	S	5
1,2,4-Trichlorobenzene	S	5
Ethyl Acetate	P	5
Isopropyl Acetate	P	5
n-Amyl Acetate	P	5
Acrylonitrile	N	5
1,1,2-Trichloro-1,2,2-trifluoroethane	S	5
Methyl tert-butyl ether	S	5
Bromochloromethane	S	5
1,2,3-Trichlorobenzene	S	5

The reporting limits for NAPL are 5,000 ug/kg for the above analytes.

N=NPDES (EPA Method 624, Total Toxic Organics), S= Superfund(SOM01.1), P=Pharmaceuticals

Notes: Reporting limits are based on the lowest calibration standard for water sample.

Table 6 -QA/QC REMARK CODES

Qualifier Code	Definitions
U	The analyte was not detected at or above the reporting limit
J	The identification of the analyte is acceptable; the reported value is an estimate
UJ	The analyte was not detected at or above the reporting limit. The reporting limit is an estimate.
N	There is presumptive evidence that the analyte is present; the analyte is reported as a tentative identification.
NJ	There is presumptive evidence that the analyte is present; the analyte is reported as a tentative identification. The reported value is an estimate.
K	The identification of the analyte is acceptable; the reported value may be biased high. The actual value is expected to be less than the reported value.
L	The identification of the analyte is acceptable; the reported value may be biased low. The actual value is expected to be greater than the reported value.
R	The presence or absence of the analyte cannot be determined from the data due to severe quality control problems. The data are rejected and considered unusable.
NV	The analysis has not been validated in LIMS.
INC	The project is incomplete. There are analyses which need to be validated in LIMS.

Table 7 - TCLP REGULATORY LEVELS

Analyte	Regulatory Level(mg/L)
Benzene	0.50
Carbon tetrachloride	0.50
Chlorobenzene	100
Chloroform	6.0
1,2-Dichloroethane	0.50
1,1-Dichloroethylene	0.7
2-Butanone [Methyl Ethyl Ketone]	200
Tetrachloroethylene	0.70
Trichloroethylene	0.50
Vinyl Chloride	0.20